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National Atmospheric Deposition Program/National Trends Network (NADP/NTN) Site Visitation Program: Summary Report for the Period December 1984 through September 1986

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Research Triangle Park, NC

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Research Triangle Park, NC

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SUMMARY REPORT

FOR

THE NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/ NATIONAL TRENDS NETWORK (NADP/NTN) SITE VISITATION PROGRAM

For the Period December, 1984 through September, 1986

by

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Research Triangle Park, North Carolina 27709

EPA Contracts 68-02-3767 and 68-02-4125

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This document is a summary report of the findings from the 1985-1986 Site Visitation Program to the 195 sites that comprise the National Atmospheric Deposition Program and National Trends Network precipitation networks, referred to collectively as the NADP/NTN network. In its present configuration the NADP/NTN network's research and monitoring programs are supported and operated by the U.S. Geological Survey, State Agricultural Experiment Stations, the Departments of Agriculture, Interior, Commerce and Energy, and the Environmental Protection Agency. Additional support is provided by state agencies, public utilities, and industry.

Protocols and procedures followed in conducting the site visits are described. Results of systems and performance audits are discussed for siting, collection equipment and the field support laboratories.

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ABSTRACT

The proper collection of precipitation and the accurate measurement of its constituents are important steps in attaining a better understanding of the distribution and effects of "acid rain" in the United States. One of NAPAP Task Group IV's major programs concerns Wet Deposition monitoring. One of that program's projects, 4A-15, "Quality Assurance Support for Wet Deposition Monitoring" is sponsored by EPA to evaluate the sample collection process of the NADP/NTN networks through a site visitation program. Research Triangle Institute, as contractor to EPA, conducts these visits. If deficiencies or nonstandard procedures are noted, the site operator and supervisor are notified. Brief reports are sent to the EPA Principal Investigator and the NADP/NTN Quality Assurance Manager. In this way, necessary changes can be made promptly.

This document is a summary report of the findings from the 1985-1986 Site Visitation Program to the 195 sites that comprise the National Atmospheric Deposition Program and National Trends Network precipitation networks, referred to collectively as the NADP/NTN network. In its present configuration the NADP/NTN network's research and monitoring programs are supported and operated by the U.S. Geological Survey, State Agricultural Experiment Stations, the Departments of Agriculture, Interior, Commerce and Energy, and the Environmental Protection Agency. Additional support is provided by state agencies, public utilities, and industry.

Protocols and procedures followed in conducting the site visits are described. Results of systems and performance audits are discussed for siting, collection equipment, and the field support laboratories.

Where exceptions are found, the potential effects of nonstandard siting, improperly operating equipment, and improper sample handling or analysis technique on the data base are discussed. Recommendations are given for improvement and standardization of individual sites and the network as a whole.

This report was submitted in fulfillment of Task 231B of EPA Contract No. 68-02-4125 by Research Triangle Institute. This report covers site visits made during the period December 18, 1984 through September 19, 1986, and all work was completed as of April 30, 1987.

ACKNOWLEDGEMENTS

The authors express appreciation to all participants in the NADP/NTN Precipitation Network (site operators, analysts, supervisors, and regional coordinators) for their help in arranging for the site visits and their interest in the program. The assistance of personnel from the NADP/NTN Coordinator's Office (D. S. Bigelow, G. E. Byers, and J. H. Gibson), the Central Analytical Laboratory (S. Dossett, V. C. Bowersox, J. M. Lockard, M. E. Peden, and G. Stensland), and the Science Research Laboratory of the United States Military Academy (Majs. J. K. Robertson and R. C. Graham) is also appreciated. The advice and encouragement of the EPA Project Officer, B. I. Bennett, are also acknowledged.

SECTION 1
INTRODUCTION

This document is the summarizing report of quality assurance assistance and findings from site visits made to the National Atmospheric Deposition Program/National Trends Network (NADP/NTN) precipitation collection stations in the period December 1984 through September 1986. Each site is located and operates according to protocols and procedures as given in the siting and operating manuals for the networks (1, 2, 3, and 4). The purposes of the site visitation program, sponsored by the U.S. Environmental Protection Agency, are to verify that each site is operating according to established procedures and to provide technical assistance as required.

All 195 operating sites were visited during this time frame. Table 1 lists the sites by name, their identification numbers, the names of each site's supervisor and operator, and the date of the site visit. Figure 1 shows the locations of the sites.

GOALS

The goals of the site visitation program for quality assurance assistance to the NADP/NTN collection sites are to:

(1) Provide a qualitative assessment of each site and its surroundings, the operator's adherence to sample collection and analysis procedures, and the condition of the site's collection and analysis equipment through an on-site systems survey;

(2) Provide a quantitative assessment of the operation of the precipitation collector and the accuracy of response of field and laboratory measurement devices for precipitation depth, mass, temperature, conductivity, and pH through an on-site performance survey;

(3) Provide technical assistance to the operator by verbal explanation, minor troubleshooting, repair and calibration of equipment, and by making recommendations for sources of corrective action;

(4) Prepare brief reports for each site detailing site characteristics, results of quality assurance tests, and technical assistance provided. Submit the reports to the NADP/NTN Quality Assurance Manager, the Central Analytical Laboratory's Site Liason, and the EPA Project Officer;

TABLE 1. NADP SITES VISITED

Site Name	ID	Supervisor	Operator	Date of Site Visit
Blackbelt	011000	Ira Giles	Harold Grimes	03/22/85
Sand Mtn	011020	Charles Jenkins	James Burns	03/18/85
Denali	020390	John Dolle-Molle	Joe Van Horn	09/09/86
Oliver Knoll	030360	Del Moliter	Cindy Alvarez	03/04/86
Grand Canyon	030370	Rick Ernenwyn	Dave Sharron	03/10/86
Organ Pipe Cactus	030620	Bill Mikus	Richard Anderson	03/05/86
Warren	040260	William Pope	French Wynne	03/10/86
Caddo Valley	040380	James Petersen	David Honnel	03/12/86
Buffalo NR	041620	Patrick Toops	Michael Holmes	03/13/86
Fayetteville	042700	Kenneth Steele	Pat Thasan	03/14/86
Tanbark Flat	054200	Paul Miller	Chuck Colver	01/14/86
Hopland	054540	Milton Jones	Jerry Scrivner	01/22/86
Palomar	056820	Jack Brunton	Tom Reel	01/13/86
Sequoia	057550	Dave Parsons	Tom Stohlgren	01/16/86
Montague	057680	Keith Polinoski	Ken Corbin	01/24/86
Chuchupate	058501	Keith Polinoski	Gail Conklin	01/15/86
Davis	058840	Bob Burgy	^	01/21/86
Yosemite	058850	Steve Botti	Teri Grossi	01/17/86
Alamosa	060060	Harvey Teyler	Sheila Hokenson	09/16/86
Las Animas	060180	Bill Pain	Ron Steger	09/18/96
Niwot Saddle	060220	Mark Noble	Mark Losleben	09/13/85
Mesa Verde	061530	Bob Heyden	Marylyn Colyer	09/15/86
Sand Spring	061560	Marylu Kastens	Jody Sherm	09/12/86
Rocky Mtn Nat Park	061910	David Stevens	Robert Porter	10/11/85
Loch Vale	061911	Jill Baron	Sarah Spalding	09/10/86
Buffalo Pass	061920	Dave Hackett	Mary Pendergast	09/11/86
Manitou	062120	Carl Edminsten	William Knot	09/19/86
Pawnee	062220	J. Byers	D. Hazlett	10/11/85
Bradford Ft	100360	Dr. Riekert	Larry Korhnak	02/05/85
CIFANT	100380	Tom Dreschel	Tom Dreschel	02/06/85
Everglades	101190	Dan Schiedt	Christy Wrightsman	02/08/85
Quincy	101400	Marvin Franklin	Gerald Losey	02/04/85
Verna Well	104100	Brian Adams	Larry Windon	02/07/85
Bellville	112040	Jim Rakestraw	J. D. Sapp	02/27/85
Ft Frederica	112380	Ellen Britton	Robert Vogel	01/15/86

TABLE 1 (cont). NADP SITES VISITED

Site Name	ID	Supervisor	Operator	Date of Site Visit
Georgia Stn	114140	Jerry Walker	John B. Medlin	02/25/85
Tifton ARS	115000	Gary Buell	Homer Allison	02/26/85
Mauna Loa	120080	Richard Artz	Alan Yoshinaga	08/05/86
Craters of the Moon	130343	Neil King	Mary Laspina	06/14/86
Headquarters	130480	Wendell Bryce	F. N. Cochrell	07/16/85
Reynold's Creek	131180	Gordon Stephenson	Anne Veigel	07/19/85
Smith's Ferry	131500	Victor Kollak	Mary Samuelson	07/20/85
Bondville	141160	Dr. Gary Rolfe	Scott Dossett	05/02/86
Shabbona	141800	Cary Rolfe	Dave Lindgren	09/09/85
Argonne	141980	Marvin Wesely	Doug Sisterson	09/10/85
Southern Il Univ	143580	G. M. Aubertin	Raymon Albright	05/14/86
Salem	144740	^	Bill Nelson	05/15/86
Dixon Springs	146340	Lester Arnold	Claris Barger	05/13/86
Monmouth	147860	Mike Mainz	Jay Sutor	04/29/86
Huntington Res	152020	Cheryl Silcox	Cary Zeissig	09/19/85
SW Purdue Ag Ctr	152260	William McFee	Melborn Long	09/10/85
Indiana Dunes	153421	Lou Brunansky	Lou Brunansky	09/13/85
Purdue U Ag Farm	154100	William McFee	Michael Szumski	09/13/85
Big Springs	160880	Jerry Spykerman	Jerry Spykerman	07/23/86
McNay Research Stn	162320	Jim Secor	Jim Secor	07/28/86
Farlington	170740	James Puttnam	Steve Mense	06/16/86
Konza Prairie	173120	Tim Seastedt	John Briggs	06/17/86
Lake Scott	173280	Curtis Sauer	Gene Reystead	06/19/86
Perryville	180360	Kevin Butt	John Townes	10/03/85
LC Woods	182260	Richard Artz	Michael Brotzge	04/15/85
Clark State	183560	Greg McCombs	Danice Nutter	05/15/86
Land Btwn the Lakes	183860	Rick Simmons	Rick Simmons	05/14/86
Hill Farm	190620	Sam Feagley	G. D. Ayers	03/11/86
Iberia	191260	Sam Feagley	Louis West	02/25/86
SE Research Stn	193060	Sam Feagley	Louis West	02/24/86
Acadia	200011	^	Kyle Jones	07/23/85
Caribou	200045	Rick Artz	John Chiaramonte	07/25/85
Presque Isle	200046	J. Lloyd, R. Artz	Karl Delang	07/26/85
Bridgton	200275	Leighton Carver	Peter Lowell	07/22/85
Greenville	200935	Ivan Fernandez	Llew Wortman	07/24/85

TABLE 1 (cont). NADP SITES VISITED

Site Name	ID	Supervisor	Operator	Date of Site Visit
White Rock	210360	Jack Lodge	R. L. Dalton	06/25/86
Wye	211320	Russ Brias Field	Mike Newell	02/21/85
NACL	220155	Mary Foley	John Portnoy	09/08/86
Cadwell Creek	220815	Don Mader	David Adams	08/05/86
East	221325	William Feder	Irving Perkins	09/09/86
U of MI Biol Stn	230920	Dan Richter	Bob Van de Kopple	09/17/85
Raco	230980	Darrel DeRouin	Justin Carrick	09/16/85
Houghton	232241	Bob Stottlemyer	Pat Toczydlowski	09/15/86
Isle Royale NP	232571	Bob Stottlemyer	Mike Bencie	09/16/86
Kellogg Bio Stn	232660	^	Jim Bronson	09/18/85
Pine River	235340	Sandy Verry	William Dunn	07/30/86
Marcell Stn	241660	Elon Verry	Arthur Elling	06/18/85
Fernburg Stn	241840	Robert Berrisford	Christine Barton	06/17/85
Camp Ripley	242360	Mark Have	Mary McQuire	06/19/85
SW Experimental Stn	242720	Wallace Nelson	Tony Strauser	07/24/86
Clinton	251080	Paul Grantham	William Morris	03/21/85
Meridian	251460	Richard Artz	Daniel R. Mondella	03/21/85
Coffeeville	253000	Paul Grantham	Hillard Griffin	03/20/85
Ashland Wildlife	260380	John Krstansky	Hal Witt	06/09/86
University Forest	260560	Grey Henderson	Jim Joiner	09/09/85
Custer Battlefield	270060	Jim Court	Clifford Arbogast	10/21/85
St Mary Station	270560	Dave Lange	Bus Cobell	09/16/86
Glacier NP FWS	270570	Dave Lange	Kelly Webb	09/15/86
Havre	270740	Rodger Knapton	Al Horsley	09/12/86
Clancy	270760	Rodger Knapton	Wayne Wood	09/17/86
Give-Out-Morgan	271340	Dallas Gudgel	Dallas Gudgel	08/15/86
Mead	281520	Dr. Shashi Verma	Howard Earl	06/18/86
North Platte	281580	Bob Swanson	Jim Goeke	06/19/86
Red Rock Canyon	290080	Dave Schafersman	Ken Miller	03/06/86
Saval Ranch	290140	Don Sieber	Carolyn Bohn	06/12/86
Smith Valley	290360	Dick La Camere	Kenny Garcia	06/11/86
Lehman Cave	290560	Bill Wagner	Norm Hiestand	06/10/86
Hubbard Brook	300240	James Hornbeck	Wayne Martin	09/10/86
Washington Crossing	312980	Rick Artz	Kathy McCullough	11/19/85
Gila Cliff	320180	Ed Payton	Patty Brown	02/28/86

TABLE 1 (cont). NADP SITES VISITED

Site Name	ID	Supervisor	Operator	Date of Site Visit
Bandelier	320720	David Nochumson	Michael Trujillo	03/25/86
Mayhill	320840	Chris Anderson	Patricia Irwin	02/27/86
Cuba NM	320980	Chris Anderson	David Bodine	03/24/86
Capulin Mountain	321280	George West	George West	09/17/86
Aurora	330860	Warren Knapp	Don Potter	11/13/85
Chautauqua	331000	Bob Brombos	Tom MacKowski	08/14/86
Huntington	332020	Dudley Raynal	Ray Masters	07/29/86
Whiteface Mtn	332020	John Kadlecek	Mark DuBois	11/12/85
West Point	335141	Richard Graham	Gary Wojciechowski	08/07/86
Bennett Bridge	335240	James Morgan	Paul Dehm	08/11/86
Jasper	336500	Harvey Paige	C. Klingensmith	08/13/86
Biscuit Brook	336840	Peter Murdoch	Jim Marlon	08/11/86
Lewiston	340320	Steve Herlocker	Julia Skinner	01/16/86
Coweeta	342500	Wayne Swank	Kitty Reynolds	04/19/86
Piedmont Res Stn	343460	Robert Bruck	Anne Lentz	12/17/85
Clinton Crops	343560	Bill Alsop	James Shaw	07/02/85
Jordan Creek	343600	Kent Crawford	Avery J. Dennis	12/18/84
Finley Farm	344160	Judy Elson	Judy Elson	01/14/85
Clingman's Peak	344500	^	Al Hendler	09/23/86
T.R. National Park	350700	Gerard Baker	Skip Snow	08/14/86
Icelandic State Pk	350880	Robert Houghton	Karen Doray	08/11/86
Woodworth	351180	Robert Houghton	Mike Callow	08/13/86
Oxford	360900	John Kliuk	Joe Nestor	11/20/85
Delaware	361760	L. S. Dochinger	Carolyn McQuattle	11/21/85
Caldwell	364900	Craig Weidensaul	Cheryl Capek	09/30/85
Wooster	367160	Craig Weidensaul	Cheryl Capek	09/30/85
Salt Plain NWR	370060	Ron Sullivan	Bill Long	03/27/86
Great Plains	371740	John Carter	Sherman Fredrickson	03/18/86
Clayton Lake	372580	Ed Miller	Beverly Robinson	03/17/86
Goodwell	372920	Eugene Reeves	Eugene Reeves	03/26/86
Alsea Guard	380200	Danny Rambo	Sam Giacopelli	06/21/85
Hyslop Farm	380202	Danny Rambo	Sam Giacopelli	06/21/85
Bull Run	380260	Joe Rinella	Art Smith	06/20/85
Silver Lake	380980	Joe Rinella	Charlie Plumb	06/24/85
Andrews Forest	381020	Art McKee	John Moreau	06/25/85

TABLE 1 (cont). NADP SITES VISITED

Site Name	ID	Supervisor	Operator	Date of Site Visit
Vines Hill	381120	Judy Nelson	Daniel Brown	07/18/85
Starkey Exp Stn	381800	Joe Rinella	Robert Sommer	07/17/85
Penn State	391520	Rosa de Pena	Dick Thompson	11/18/85
Kane Exp Forest	392940	Dave Marquis	David Saf	11/15/85
Leading Ridge	394200	Jim Lynch	Kevin Kostchnik	06/24/86
Milford	397220	Bob Neville	Kelly Jones	08/08/86
El Verde	402020	Clyde Asbury	Carlos Ramos	09/26/86
Santee NWR	420680	Richard Hayes	Glen Bond	02/28/85
Clemson	421880	Dr. Craddock	Steve Hodges	05/27/86
Huron Well Field	430061	Jack Little	G. R. Wisnieski	07/25/86
Cottonwood	430880	Richard Artz	Glen Bennet	08/19/86
Walker Branch	440040	Steve Linburg	Jan Coe	04/17/85
Giles Co	441140	Charles Jenkins	Steve Clark	03/19/85
GSMP-Elkmont	441190	John Peine	David Solstee	04/18/86
Hatchie NWR	441400	Bruce W. McMaster	John Koons	05/06/86
Muleshoe NWR	450250	Rod Krey	Al Jones	03/21/86
Beeville	450350	Richard Artz	Candy Moore	03/29/85
K-Bar Big Bend NP	450425	Mike Flemming	Mike Flemming	02/25/86
Attwater	451040	Wayne Shifflett	Gary Montova	03/27/85
Sonora	451650	Charles Taylor	Nick Garza	02/24/86
Longview	452180	Dick Leard	Roddy Sloan	03/25/85
Guadalupe Mtns NP	452215	Phillip Knepp	O. Olsen	02/26/86
Forest Seed	453800	Kay Humphreys	Kay Humphreys	03/26/85
Throckmorton	455180	Rod Heitschmidt	Steve Dowhower	03/20/86
Victoria	455350	Bob James	Donald Faulkner	03/28/85
LBJ Nat Grassland	455640	Bill Herb	Clyde Schoultz	03/19/86
Bryce Canyon	460110	Bill Wagner	Mike McGinnis	03/07/86
Logan	460120	Gail Bingham	Scot Smith	03/13/86
Green River	460281	Bill Wagner	Nolan Johnson	03/11/86
Bennington	470100	Richard Poirot	Gail Tiffany	08/06/86
Underhill	470180	Leo Topol	Sumner Williams	09/11/86
Charlottesville	480060	Linda Jolly	Linda Jolly	02/05/85
Horton Stn	481300	Dr. Chevone	Art Chappelko	02/18/85
Big Meadows	482890	Jim Watkins	Jim Burke	02/20/85
Loves Mill	483300	William Parkhurst	Steve McLemore	04/16/86

TABLE 1 (cont). NADP SITES VISITED

Site Name	ID	Supervisor	Operator	Date of Site Visit
Olympic NP	491410	John Aho	Hunter Sharp	06/19/86
Sullivan Lake	491540	Tom Loranger	Keith Fletcher	07/15/85
Marblemount	491940	Tom Loranger	Gennie Harsha	06/18/86
La Grande	492180	Tom Loranger	Stan Human	06/17/85
Palouse Farm	492420	Keith Saxton	Robert Pust	08/08/86
Babcock State Park	500460	Ted Ehlke	Gary Crosby	10/01/85
Parsons	501860	Jim Kochenderfer	James Phillips	10/02/85
Suring	512500	Bruce Rodger	James Trochta	06/11/85
Lake Dubay	512800	Dan Herman	R. Aschenbrenner	06/12/85
Trout Lake	513640	Bruce Rodger	Ronald Capacio	06/13/85
Lake Geneva	513680	Bruce Rodger	Ted Peters	06/10/85
Spooner	513700	Bruce Rodger	Karen Hirch	06/14/85
Snowy Range	520020	Frank Sanders	Jim Sherman	09/09/86
Sinks Canyons	520260	Al Riebau	Greg Bautz	06/18/86
South Pass	520261	Al Galbraith	Skip Shoutis	06/17/86
Pinedale	520680	Al Riebau	Steve Laster	06/19/86
Gypsum Creek	520681	Tony Littlejon	Dean Grover	06/16/86
Newcastle	520820	Al Riebau	Ira Craig	08/18/86
Tower YNP	520860	Jana Mohrman	Randy King	09/18/86
American Samoa	530190	Richard Artz	Emily Wilson	08/08/86

TABLE 1 (cont). NADP SITES VISITED

Site Name	ID	Supervisor	Operator	Date of Site Visit
Olympic NP	491410	John Aho	Hunter Sharp	06/19/86
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Marblemount	491940	Tom Loranger	Gennie Harsha	06/18/86
La Grande	492180	Tom Loranger	Stan Human	06/17/85
Palouse Farm	492420	Keith Saxton	Robert Pust	08/08/86
Babcock State Park	500460	Ted Ehlke	Gary Crosby	10/01/85
Parsons	501860	Jim Kochenderfer	James Phillips	10/02/85
Suring	512500	Bruce Rodger	James Trochta	06/11/85
Lake Dubay	512800	Dan Herman	R. Aschenbrenner	06/12/85
Trout Lake	513640	Bruce Rodger	Ronald Capacio	06/13/85
Lake Geneva	513680	Bruce Rodger	Ted Peters	06/10/85
Spooner	513700	Bruce Rodger	Karen Hirch	06/14/85
Snowy Range	520020	Frank Sanders	Jim Sherman	09/09/86
Sinks Canyons	520260	Al Riebau	Greg Bautz	06/18/86
South Pass	520261	Al Galbraith	Skip Shoutis	06/17/86
Pinedale	520680	Al Riebau	Steve Laster	06/19/86
Gypsum Creek	520681	Tony Littlejon	Dean Grover	06/16/86
Newcastle	520820	Al Riebau	Ira Craig	08/18/86
Tower YNP	520860	Jana Mohrman	Randy King	09/18/86
American Samoa	530190	Richard Artz	Emily Wilson	08/08/86

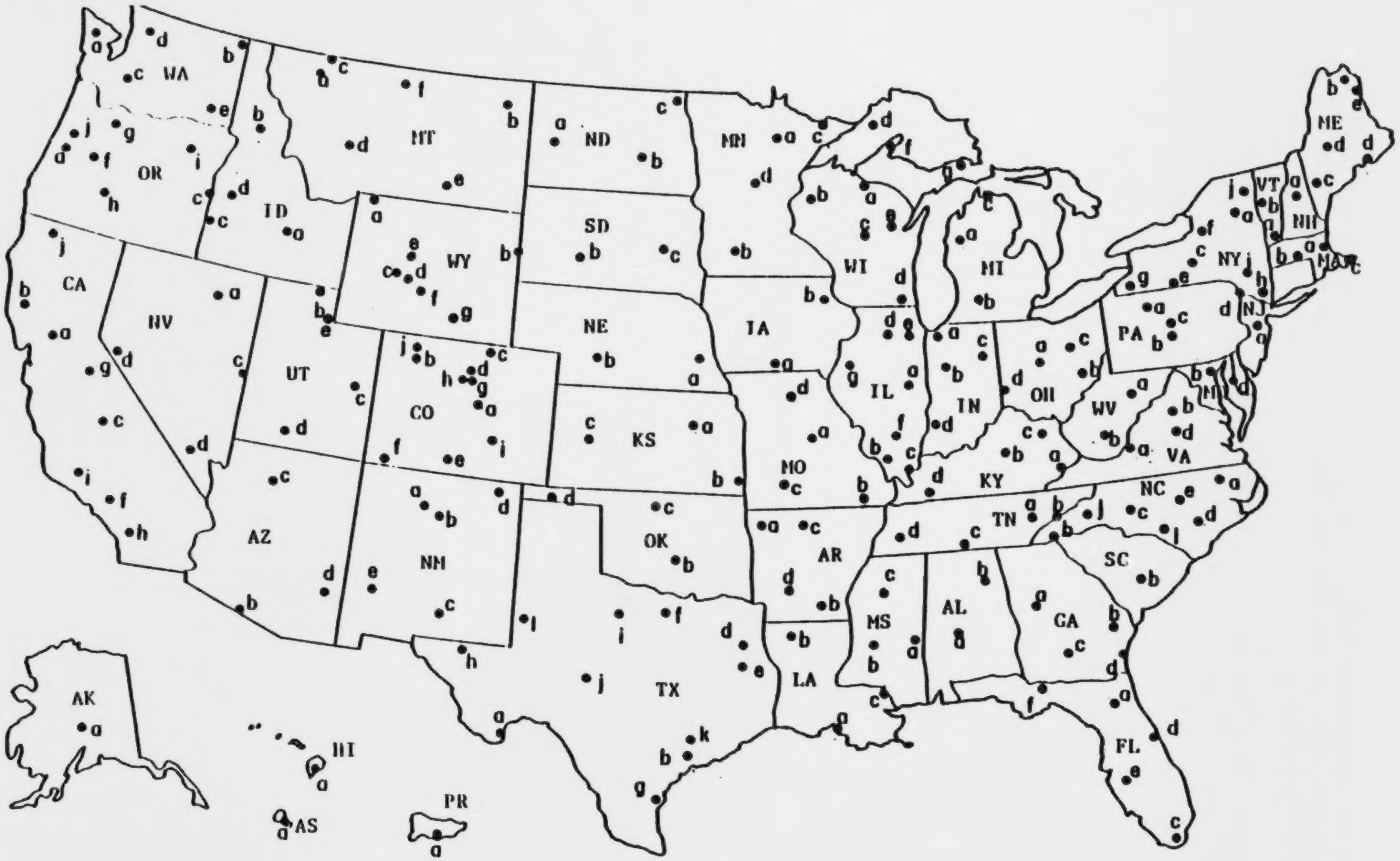
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Figure 1. Active Sites In The NADP/NTN Monitoring Network As Of 9/30/86.

(5) Computerize results of all information gathered from each site and submit this to the NADP/NTN Quality Assurance Manager on a quarterly basis;

(6) Document the sites and their surroundings by assembling a collection of site maps and color photographs.

This report is divided into seven sections and two appendices. They are as follows:

Section	Topic
1	Introduction
2	Conclusions
3	Recommendations
4	Approach
5	Protocols and Procedures for Collection Site Visits
6	Site and Field Laboratory Results and Discussion - Siting Survey - Field Laboratory Survey
7	References
Appendix A	Siting Criteria for the NADP/NTN Precipitation Collection Sites
Appendix B	Questionnaires for Systems and Performance Surveys of NADP/NTN Field Sites

SECTION 2

CONCLUSIONS

One hundred ninety-five NADP/NTN precipitation collection sites were visited over the two year period, December 1984 through September 1986. The sites are spread over all regions of the country and are sponsored and operated by numerous agencies according to standard operating procedures and siting criteria. This report assesses the degree to which procedures and criteria are adhered to and to predict, where possible, the relative impact on the data which might be expected from the variances found.

SITING

All 195 sites had at least one variance with respect to siting criteria. Forty-four percent of the sites had 4 or more variances. A total of 660 siting variances were noted. Most of the variances, due to the nature of certain criteria and/or the degree to which the criteria were exceeded, will have minimal effects on the data base. For example, network siting criteria require that the precipitation collector and rain gauge be separated by at least 5 m and no more than 30 m. Thirty percent of the sites failed to meet this criterion, always because of inadequate separation. It is not likely that the effect is measurable in the precipitation chemistry or catch efficiency as compared to a site which meets the criterion. Variances concerning collector height, use of platforms, wet bucket orientation, ground slope, enclosed collector bases, collector-gauge separation, collector-gauge heights, vegetation higher than 2 feet, and animals within 30 m account for half of the variances and probably have little effect on the data. The remainder of the variances are due to the presence of potential pollutant sources of various types near the sites. It is felt that variances, with respect to pollutant sources, may have measurable effects on the data but because the type, magnitude, and proximity of the sources vary widely from site to site, a measure of the effects is not possible from the data gathered in this site visitation program.

SAMPLE COLLECTION

Designated sample collection procedures are adhered to at almost all the sites in the network. All operators are careful not to touch the inside of the collection bucket or lid or contaminate the sample in anyway. The most frequently neglected sample collection procedure is the requirement that site operator check the sample for contaminants (leaves, bird droppings, etc.) at the time of the bucket's removal from the collector. It is recommended that this procedure be re-emphasized as most of the site operators were not making this check.

To ensure accurate precipitation data, it is most important that the precipitation collector and rain gauge are properly working and well-maintained. A properly working precipitation collector should uncover the wet bucket at the beginning of a precipitation event, recover the wet bucket shortly after the event stops, and keep dust, etc. out of the wet bucket when there is no precipitation. There were strong indications at 66 sites (34% of the total) that the Aerochem Metrics precipitation collectors could not properly perform all these functions. Forty-eight percent of the rain gauges were found to be out of calibration by more than ± 0.1 inch at some point on the 0-12 inch scale. Although it is believed this will not be a major source of error (see Section 6), it is thought current rain gauge maintenance and check procedures should be improved.

FIELD LABORATORY PROCEDURES

Laboratory analysis procedures were discussed or demonstrated with site operators when needed. For the most part, incorrect procedures were only used by operators who had not yet attended the CAL training course. However, poor analysis technique or improper procedure did not necessarily always result in significant measurement error based on the results of audit test solution analysis. Eighty-seven percent of the sites agreed with the audit solution's designated pH value within ± 0.1 pH unit and of the 26 sites that exceeded this criterion, 15 sites clearly had faulty or failing pH electrodes. Ability to measure conductivity accurately within ± 4 μS/cm was outstanding; ninety-five percent of the sites were within 4 μS/cm of the audit solution's designated conductivity value.

SECTION 3
RECOMMENDATIONS

The site precipitation collector and rain gauge are central to the successful operation of the network. Based on the frequency of noted problems with collector operation and rain gauge calibration, it is recommended that the importance of weekly equipment checks be re-emphasized to site operators and that additional items such as the collector clutch assembly be added to the inspection list. CAL is best suited to devise an appropriately thorough, weekly check procedure. A simple check of the collector's sensor heater can be made by activating the collector with water and, after five minutes, lightly touching the sensor surface to verify it is heating.

Since rain gauge charts are now sent to CAL, more experienced personnel there may be able to spot problems sooner but a thorough weekly check by the site operator could prevent many problems from occurring. It is also recommended that a calibration check of the rain gauge be instituted and carried out every six months with a copy of the gauge chart used for the check forwarded to CAL.

It is recommended that guidance in the proper annotation of rain gauge charts be provided to site operators. Currently many operators offset the rain gauge charts by one day as recommended but a substantial number do not. This information along with bucket on and off times, etc. should be documented on the charts. Use of a redesigned chart that begins on Tuesday would be very helpful in this regard. This is to occur.

Sample collection procedures are generally well understood and adhered to across the network. One procedure, inspection for sample contamination at the site, is frequently neglected. The importance of this check should be restated to site operators.

It was observed that those site operators who had attended the CAL training course generally had a better understanding of procedures. It is recommended that the CAL training course be continued and that site operators be encouraged to attend whenever possible.

It is not possible to accurately check the relationship of sites to potential pollutant sources within a 20 km radius during the few hours available for the site visit. It is recommended that the NAPAP emissions data base be used to plot the locations, strengths, and type of sources with respect to the sites. An interpretive study of whether nearby sources may have had an effect on the chemistry of the sample should then be made through use of the NAPAP emissions data base, the data from the sites near sources, and data from sites well removed from sources. Nearby, small sources should be included if possible.

The quality assurance information provided by these site visits is only a portion of the total available. It represents only a "snapshot" of the total monitoring period. It is recommended that the site visit information be merged with other site and CAL-acquired information to allow a more comprehensive evaluation of the effect of variations on the total data base. For instance, it was found that the collector's sensor was not heating at some sites. Other sources of information may be used to deduce over what period it was malfunctioning (a careful examination of the opening/closing cycles as shown on the recording rain gauge chart; review of site logbook to note repair date). The data base itself could be examined to see if such a malfunctioning collector affected the chemistry of the sample(s). For instance, the pH values may be unusually high, indicative of dust intrusion and base neutralization of the sample.

SECTION 4
APPROACH

The following five-step approach was utilized in preparing for and conducting visits to precipitation collection sites in the NADP/NTN network.

DOCUMENT REVIEW AND PREPARATION OF A SITE VISITATION QUESTIONNAIRE

Pertinent network documents and reports (1, 2, 3, 4, and 5) were reviewed and from them draft and final work plans and questionnaires were prepared that are specific to the operation of the NADP/NTN Network. The questionnaire was used to conduct systems and performance surveys of the site and field laboratory operations and the operator's adherence to designated procedures.

SITE VISITOR PLANNING AND TRAINING SESSIONS

Three RTI personnel attended a meeting October 11 and 12, 1984, at the United States Military Academy, West Point, New York. At this meeting further instructions and information concerning the NADP/NTN sites and desired quality assurance activities were obtained. The NADP/NTN site visitation checklists (6) created and used by Majors Robertson and Graham during their visits in 1982-1983 were reviewed. The Biscuit Brook and West Point monitoring sites were visited and procedures for site systems and performance audits were observed.

All RTI site visitors have also attended and participated in an instructional course for NADP/NTN site operators. These courses were held at the Illinois State Water Survey laboratory in Champaign, Illinois, the contractor for the network's Central Analytical Laboratory (CAL). Information on quality control results was obtained and the CAL-operated site (Bondville, Illinois) was visited. These training sessions gave members of the site visitation team the opportunity to meet site operators in advance of the visits and to learn what is expected of a site operator.

Additional planning sessions were held at the Illinois State Water Survey and at a technical conference in Boulder, Colorado. The outcome of all these discussions and training sessions was the final work plan which includes audit questionnaires for systems and performance audits (7).

ESTABLISH CONTACT WITH PERSONNEL AND SPONSORS WHOSE SITES ARE TO BE VISITED

In coordination with the EPA Project Officer, contact was made by telephone and letter with those persons whose sites were to be visited. The site supervisor and operator were encouraged to be present. The dates for the site visits were set, the itinerary planned, and information, such as topographical maps, were acquired and studied prior to the actual site visit.

VISIT AND EVALUATE SITES AND PROVIDE TECHNICAL ASSISTANCE

The sites and field laboratories were visited and evaluated. During the visit, the questionnaires were completed and each site was documented by sketch and photographs. The site's location was verified on a USGS 1:24,000 series map. During the first of several visits to local sites, two or more members of the site visitation team were present. An "idea and technique" sharing session followed the visit so that on future trips each visitor would employ a similar routine, asking questions, and giving technical assistance in a uniform manner.

The site visits began in December, 1984, and continued through September, 1986. All 195 of the NADP/NTN sites in operation or coming on line during this time frame were visited.

REPORTING OF RESULTS

Four types of reports were used in the site visitation program. They are:

- Brief handwritten exit reports;
- Quarterly data summary reports;
- Annual reports to the NADP at the time of the annual technical review session;
- Computerized tapes and printouts containing all answers and comments recorded in the site visitation notebooks.

Throughout the site visit, the site visitor verbally briefed the supervisor and operator on the results of the systems and performance survey. Soon after the visit, a copy of the handwritten exit report was provided to them. The purpose of the briefing and the report was to convey information only. Copies of this brief report of the survey results and recommendations for corrective action were mailed to the site liason at CAL and to the NADP/NTN Quality Assurance Manager at the Coordinator's Office. Figure 2 illustrates the categories covered in the brief report.

NADP/NTN SITE SURVEY RESULTS

Notebook No. ______________

Site Name ____________________________ Date of Visit ____________

Site Number __________________________ Visitor's Name ____________

Site Operator's Name ____

Site Supervisor's Name ____

Supervisor in Attendance? ____

SITING

Obstructions? ____

Sources? ____

Violations of Criteria? ____

____

EQUIPMENT AND SAMPLE COLLECTION

Aerochem Metrics Collector ____

Bucket Handling ____

Belfort Gauge ____

Other ____

RECORDKEEPING

____

MANUALS/SUPPLIES NEEDED

____

TEST RESULTS	SITE VALUE	DESIGNATED VALUE
Conductivity		
pH		
Mass		

Corrective Actions Taken or Recommended ___________________________

____

____

Figure 2. Form for Brief Report of Site Visit.

Bound copies of the original notebooks containing the site survey results are kept on file at RTI. Copies of the notebooks, the photographs, and annotated maps are sent the the QA Manager's office for study and archiving.

Draft reports summarizing the information from site surveys were prepared on a quarterly basis and distributed to the NADP/NTN Quality Assurance Manager and the EPA Project Officer. These quarterly reports consisted mainly of tabulated summaries of site survey results and recommendations for corrective action as warranted.

An annual report, consisting of a technical summary of the year's activities, was presented in a briefing to NADP/NTN at the time of the annual technical meeting. A technical paper was presented at the October, 1985 meeting held in Fort Collins, Colorado. A poster session was presented at the October, 1986 meeting in Atlanta, Georgia.

The last type of report was a computerized file of all questions/answers and comments from each of the site visitation program notebooks. These validated files were submitted to the Coordinator's Office at Colorado State University via electronic transfer. The transmittal of this information was comleted on February 19, 1987.

SECTION 5

PROTOCOLS AND PROCEDURES FOR COLLECTION SITE VISITS

SCHEDULING

For this particular round, each NADP/NTN site was to be visited once in a two year period. About one-half of the 195 sites were visited each year during the period 1985-1986. Prior to the scheduling of site visits, RTI consulted with the NADP/NTN Quality Assurance Manager and CAL personnel to determine which sites, if any, should be seen on a priority basis. Whenever possible, visits were planned so that several sites in the same vicinity could be seen in the same trip.

The following sequence was followed when arranging a visit to a collection site.

- About two months before the anticipated date of visit, RTI selects a set of sites in a location suitable for a trip lasting up to two weeks and set a tentative schedule for visits. As many as eight sites may be visited in this time frame, depending on the proximity of the sites.

- The NADP/NTN Quality Assurance Manager, the Central Analytical Laboratory (CAL) of the Illinois State Water Survey, and the sponsoring agency are notified by letter of the proposed visits. CAL supplies pertinent information to RTI concerning each site.

- Each site's supervisor is telephoned to set up the visit. Depending on the wishes of the site supervisor, the supervisor contacts the operator or RTI contacts the operator to confirm the date, time, and place of the visit. When the supervisor makes the arrangement, he contacts RTI prior to the planned visit to confirm or alter the initial plan.

- A form letter is sent to each site's supervisor and operator which confirms the date, time, and place of the visit. This letter also gives a brief agenda for the visit and an estimate of the time to set aside for the visit (usually 4 to 5 hours).

A flow chart of the activities carried out in preparation for, conduct of, and reporting of a site visit is given in Figure 3.

FLOWCHART FOR SITE VISITS

I. SELECT SITE FOR VISIT AND INITIAL COMMUNICATIONS

- Advise QA Manager, CAL, site sponsor of plans; request site information; receive go-ahead
- Contact site supervisor; site operator
- Send letter of confirmation to supervisor, operator
- Advise EPA that trip plans are complete

II. PRE-TRIP PREPARATION

- Make Travel Arrangements (air, car, hotel)
- Prepare and Test Quality Assurance Materials
- Review Site-Specific Quality Control Information (maps, QC test results, etc.)
- Check Equipment and Supplies
- Prepare Site Visit Notebooks

III. CONDUCT SITE VISIT

- Outline Activities to Supervisor and Operator
- Assess Site and Surroundings (map, photographs, obstructions, sources)
- QA Tests of Precipitation Collector and Gauge
- Adjust or Calibrate Collection Equipment as Required
- Assess Operator Handling and Transport of Collection Bucket
- QA Tests of Conductivity and pH Meters, Temperature, Mass
- Examination of Site Records, Rain Gauge Charts
- Answer Questions; Provide Instruction
- Prepare Short Report; Conduct Exit Interview

IV. REPORTING

- Short Report Prepared; Left with Supervisor or Operator
- Copy of Short Report Forwarded to NADP/NTN QA Manager, to CAL, and to EPA Project Officer
- Copy of Site Visit Notebook Sent to NADP/NTN, QA Manager; File Original
- Summary Reports Prepared Quarterly
- Annual Report Presented to NADP/NTN Committee

Figure 3. Flowchart for Site Visits.

PRE-TRIP PREPARATION

Prior to each trip to a set of collection sites, the following preparations were made: travel arrangements; preparation and testing of quality assurance test equipment and materials; review of site-specific quality control information; packaging and double-check of all equipment and supplies; preparation of site survey notebooks.

Review of Site-Specific Quality Control Information

Information on individual collection sites was supplied to RTI by the NADP/NTN Quality Assurance Manager's office and CAL in advance of the survey trips so that site contacts could be established and special attention given to an individual site's needs.

This information, supplied in the form of a computer printout provided by the Quality Assurance Manager, and through telephone conversations with the CAL site liason person, contained:

- The site supervisor's and operator's names, addresses, and telephone numbers
- A description of site and surroundings
- A list of equipment at the site
- Confidential information on the operator's performance
- The site description questionnaire

This information was reviewed at RTI prior to visiting the collection site. Information of a confidential nature was not discussed with the site operator.

Preparation of Site Survey Notebooks

Notebooks were prepared for use at each site. Each notebook contained information concerning the site (operator, location, etc.), a record of pre-trip confirmation of test solutions, balance weights, etc., and the site survey questionnaire. Each notebook was bound, numbered, and checked for accuracy before and after the site visit. Upon completion and review, the original notebook was filed at RTI using a document control system. One copy of the notebook was provided to the NADP/NTN Quality Assurance Manager upon request.

SITE SURVEY VISITS

RTI personnel (W. C. Eaton, C. E. Moore, D. A. Ward, E. L. Tew, R. W. Murdoch, or J. G. Suedbeck) accompanied the supervisor and/or operator to each collection site and field laboratory with the dual aims of (1) documenting the site and its immediate surroundings, its operation, and the accuracy of its instruments' responses to various quality assurance tests and (2) providing information, training, and instruction for operators and supervisors, equipment calibration and minor maintenance as needed, and establishing contacts for further information and/or major repairs. A general list of items checked is given in Table 2.

The initial set of visits was to three sites in North Carolina. For these visits RTI sent a team of three people so that each person's approach to the survey could be evaluated and discussed immediately afterwards. The goals of this team approach were to obtain additional hands-on experience and to standardize the visit as much as is practical so that the same procedures would be used when sites were later visited by an individual.

Systems Survey

A quality assurance systems survey was conducted at each site to qualitatively assess the site, its surroundings, and the operator's adherence to procedures specified in the NTN design document (1) and in the NADP/NTN site operator's instruction manual (3). The operator was asked to demonstrate sample collection and analysis procedures. These were observed with special attention given to calibration procedures and sample handling technique. Site equipment was examined for signs of wear or faulty operation. It was noted whether solutions and equipment were properly stored. Site logbooks and rain gauge charts were examined for legibility, completeness, and accuracy.

Information from the systems survey was entered in the systems survey questionnaire. (Refer to Appendix B of this report.) Photographs (color prints) of the site were taken. The directions N, E, S, and W were photographed with the precipitation collector in the foreground. Additional views were taken as specified in the questionnaire.

TABLE 2. LIST OF ITEMS TO BE CHECKED DURING SITE SURVEY VISIT

Precipitation Sampler

- lid/bucket seal
- absence of gaps
- sensor heater works
- clutch tension
- clutch wear
- winter problems
- proper counterbalance
- contamination by straps
- snow roof design, material, orientation
- level
- lid tension or drop
- bucket/sample handling
- orientation, height
- distance from other equipment

Supplies

- check inventory
- shortage of buckets
- excess buckets

Mass

- accuracy of response
- calibration weight handling
- tolerance checks
- correct use of balance

Precipitation Gauge

- winterization
- calibration of weight response
- cleanliness
- time calibration
- event marker working
- accuracy of chart reading
- Belfort gauge reported
- distance from other equipment
- height

pH Meter and Use

- accuracy of response
- no electrodes in bucket
- ± 0.2 pH unit agreement with test solution
- electrode condition
- electrode brand
- order of use
- use of pH check solution
- storage of buffers, check solutions

Conductivity

- accuracy of response
- no electrode in bucket
- use of 75 μmho/cm standard

Performance Survey

A quantitative performance survey was conducted at each site. Table 3 lists the equipment that was checked for performance and the type of test used. Criteria for evaluating performance are specified in the NADP Quality Assurance Plan (2). All information was recorded in the performance survey questionnaire (refer to Appendix B). Several items having to do with quality assurance test equipment, materials, and procedures are discussed below.

Precipitation Depth

The calibration of the Belfort recording rain gauge was checked over the range 0 to 12 inches by use of the certified weight set (Number 8849 6P-1) obtained from Belfort Instrument Company. The accuracy of the weight set was verified by periodically reweighing the weights versus NBS or IOLM traceable standards. To conduct the test, the operator removed the chart from the gauge and replaced it with a new one. Proper alignment of the chart on the drum was verified by the operator and the site visitor. Next, the zero reading was established and then a series of weights were placed on the gauge to simulate precipitation in one inch increments from 1 to 12 inches (in very dry areas only the range 0 to 6 inches may be checked). Gauge response was recorded in the notebook and on the chart.

If any one reading was greater than 0.10 inch from the designated value, the gauge was calibrated (weather permitting) using the procedure given in the gauge manual (8).

One agency (NOAA) has its own program of precipitation gauge calibrations. If a NOAA-sponsored rain gauge was found to be outside the tolerance (± 0.10 inch), the site supervisor was notified; no calibration was performed by the site visitation team.

Precipitation Collector

Several aspects of the Aerochem Metrics precipitation collector were checked. Information and check procedures are given in the collector's maintenance manual (9).

TABLE 3. NADP/NTN SITE MEASUREMENTS AND PERFORMANCE SURVEY METHODS

Site Measurement	Measurement Device	Performance Survey Method
Rain depth	Rain gauge (Belfort)	Challenge with known weights
Precipitation sample collection	Precipitation collector (Aerochem Metrics)	Measure resistance across sensor, measure tension and drop of bucket lid, measure temperature and voltage of activated sensor
Mass	Triple beam balance	Challenge with traceable weights
pH	pH meter and electrode	Challenge with simulated precipitation sample of known pH
Conductivity	Conductivity meter and cell	Challenge with simulated precipitation sample of known conductivity

Mechanical

The proper opening and closing cycle of the collector was checked by applying deionized water to the sensor and watching and timing the open-close cycle. Wear on the thrust collar indent and thrust tooth was visually checked. Clutch pressure was checked by the mechanism's ability to lift 1640 g (two Belfort calibration weights).

Tension on lid

Lid tension was checked in two ways: lifting the lid slightly with a spring scale and noting the force required; measuring the distance between the collector table top and the bottom edge of the lid with and without the collection bucket in place and noting the difference.

Sensor

The sensor's cleanliness, proper voltages, electrical resistance at which the lid displaces, and heating (measured by a thermocouple placed against the sensor plate) were checked.

Mass

The accuracy of mass determination of the collection bucket contents was checked by having the operator weigh several Belfort rain gauge weights which had been calibrated to ± 0.1 grams against IOLM-certified brass weights.

pH and Conductivity

The accuracies of pH and conductivity measurements were checked by having the site operator analyze a simulated precipitation sample. This sample was a dilute solution of one of the EPA/NBS simulated precipitation reference materials which have been in use as quality assurance materials for several years (10). The reference material was diluted per instructions and a portion checked at RTI before being taken to a collection site. The solutions were subject to recheck upon their return from a field trip. The test sample was not placed in a collection bucket, but rather was given to the operator to add to his test vessels.

Technical Assistance

Technical assistance in the form of instruction, explanation, or demostration was provided as needed to improve site performance. This assistance often included a discussion or demonstration of proper analytical techniques, instrument use, and calibration procedures. Operator questions were answered or referred to appropriate program personnel.

Whenever an equipment deficiency was found at the site, the problem was identified, corrective action recommended (see maintenance subsection) and, as necessary, the operator and supervisor were referred to CAL for additional information and guidance.

Maintenance

Minor maintenance was performed at NADP/NTN sites in an effort to improve site performance. The level of maintenance provided was limited by the amount of time required to complete a particular task and the amount of equipment which could be transported to the field.

Exit Interview

At the conclusion of the site survey, a short report of the visit was written and the results were discussed with the site operator and/or supervisor. During the exit interview the operator and supervisor were given the opportunity to ask additional questions and express their feeling about the NADP/NTN program and their responsibilities within it.

SECTION 6
SITE AND FIELD LABORATORY SURVEYS
RESULTS AND DISCUSSION

SITE SURVEY

Each NADP/NTN site is equipped with an Aerochem Metrics precipitation collector and a Belfort rain gauge. Specific procedures outlining the operation of this equipment for the collection of weekly precipitation samples are in place (3, 7, and 8). In addition, there are written siting criteria which specify minimum requirements each site should meet with regard to equipment placement, terrain, topography, and potential pollutant sources (1 and 4). Following are the results of qualitative system assessments made at each site with respect to NADP/NTN operational and siting guidelines.

Siting Criteria Survey Results

Table 4 presents the results of assessments made at each site with respect to 18 siting criteria. The results of the findings are discussed below.

Collector Height Standard

The collector should be installed on its standard 1-meter-high aluminum base. Any of several methods can be used to stabilize or level the collector such as concrete pads or stakes. However, the bucket height of the collector should not vary from its standard height by more than ± 0.5 m. An exception to this criteria is permitted in areas with significant accumulations of snow. To prevent obstructions to wind flow, the collector base should not be enclosed. Twenty-six of one hundred and ninety-four collectors checked (12%) were on platforms. One platform was short and therefore only twenty-five collectors exceeded the height criterion. The base was enclosed on nine collectors.

In most cases, platforms were short, not more than 2 to 4 feet in height. The higher platforms (Buffalo Pass and Snowy Range) were necessary to raise the collector

TABLE 4, PAGE 1. SITING CRITERIA SURVEY RESULTS

Site Name	ID	Collector Height Standard	Collector on Platform	Wet Bucket Orientation	Ground Slope > 15	Collector Base Open	Collector-Gauge Separation (m)
Blackbelt	011000	Y	N	E	N	Y	1.8
Sand Mtn	011020	Y	N	W	N	Y	4.4
Denali	020390	Y	N	ESE	Y	Y	1.4
Oliver Knoll	030360	Y	N	W	Y	Y	5.9
Grand Canyon	030370	Y	N	W	N	Y	2.0
Organ Pipe Cactus	030620	Y	N	W	N	Y	5.2
Warren	040260	Y	N	N	N	Y	6.1
Caddo Valley	040380	Y	N	W	N	Y	5.0
Buffalo NR	041620	Y	N	W	N	Y	5.3
Fayetteville	042700	Y	N	S	N	Y	2.9
Tanbark Flat	054200	Y	N	W	Y	Y	10.0
Hopland	054540	Y	N	W	Y	Y	6.2
Palomar	056820	Y	N	W	Y	Y	5.0
Sequoia	057550	Y	N	W	Y	Y	5.0
Montague	057680	Y	N	W	N	Y	6.0
Chuchupate	058501	Y	N	W	N	Y	5.0
Davis	058840	Y	N	W	N	Y	5.0
Yosemite	058850	Y	N	W	N	Y	4.0
Alamosa	060060	Y	N	NW	N	Y	6.4
Las Animas	060180	Y	N	W	N	Y	5.0
Niwot Saddle	060220	Y	N	S	Y	Y	30.0
Mesa Verde	061530	Y	N	W	N	Y	3.7
Sand Spring	061560	Y	N	W	N	Y	0.9
Rocky Mtn Nat Park	061910	Y	N	E	Y	Y	2.9
Loch Vale	061911	Y	N	W	N	Y	13.7
Buffalo Pass	061920	N	Y	E	N	Y	0.9
Manitou	062120	Y	N	W	N	Y	1.2
Pawnee	062220	Y	N	W	N	Y	14.6
Bradford Ft	100360	Y	N	E	N	Y	20.0
CIFANT	100380	Y	N	W	N	Y	5.0
Everglades	101190	Y	N	W	N	Y	4.8
Quincy	101400	Y	N	W	N	Y	5.0
Verna Well	104100	Y	N	W	N	Y	10.0
Bellville	112040	Y	N	W	N	Y	5.8
Ft Frederica	112380	Y	N	W	N	Y	5.2

TABLE 4, PAGE 1 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Collector Height Standard	Collector on Platform	Wet Bucket Orientation	Ground Slope > 15	Collector Base Open	Collector-Gauge Separation (m)
Georgia Stn	114140	Y	N	W	N	Y	5.5
Tifton ARS	115000	Y	N	W	N	Y	6.1
Mauna Loa	120080	Y	N	N	Y	Y	7.6
Craters of the Moon	130343	N	Y	W	Y	Y	5.0
Headquarters	130480	N	Y	E	N	Y	5.7
Reynold's Creek	131180	Y	N	N	N	Y	22.9
Smith's Ferry	131500	N	Y	W	N	Y	^
Bondville	141160	Y	N	W	N	Y	7.3
Shabbona	141800	Y	N	W	N	Y	3.6
Argonne	141980	Y	N	W	N	Y	13.0
Southern Il Univ	143580	Y	N	W	N	Y	5.5
Salem	144740	Y	N	N	N	Y	13.3
Dixon Springs	146340	Y	N	W	N	Y	4.6
Monmouth	147860	Y	N	W	N	Y	4.0
Huntington Res	152020	N	Y	W	N	Y	11.5
SW Purdue Ag Ctr	152260	Y	N	W	Y	Y	5.0
Indiana Dunes	153421	Y	N	N	N	Y	3.2
Purdue U Ag Farm	154100	Y	N	W	N	Y	3.5
Big Springs	160880	Y	N	W	N	Y	12.6
McNay Research Stn	162320	Y	N	W	N	Y	10.0
Farlington	170740	Y	N	W	N	N	6.0
Konza Prairie	173120	Y	N	W	N	Y	8.3
Lake Scott	173280	Y	N	W	N	Y	5.3
Perryville	180360	N	Y	N	Y	Y	^
LC Woods	182260	Y	N	S	N	Y	4.0
Clark State	183560	Y	Y	W	N	Y	7.0
Land Btwn the Lakes	183860	Y	N	W	N	Y	6.0
Hill Farm	190620	N	N	E	Y	Y	1.4
Iberia	191260	Y	N	NE	N	N	2.0
SE Research Stn	193060	Y	N	WSW	N	Y	^
Acadia	200011	Y	N	W	N	Y	9.0
Caribou	200045	Y	N	E	N	Y	5.0
Presque Isle	200046	Y	N	W	N	Y	5.5
Bridgton	200275	Y	N	W	N	Y	5.0
Greenville	200935	Y	N	E	N	Y	6.0

^ Indicates not checked.

TABLE 4, PAGE 1 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Collector Height Standard	Collector on Platform	Wet Bucket Orientation	Ground Slope > 15	Collector Base Open	Collector-Gauge Separation (m)
White Rock	210360	Y	N	W	N	Y	5.0
Wye	211320	Y	N	W	N	Y	6.0
NACL	220155	Y	N	N	N	Y	4.4
Cadwell Creek	220815	Y	N	N	N	Y	10.0
East	221325	Y	N	WSW	N	Y	2.1
U of MI Biol Stn	230920	N	Y	W	N	Y	2.3
Raco	230980	N	Y	N	N	N	5.0
Houghton	232241	Y	N	W	N	Y	10.0
Isle Royale NP	232571	Y	N	W	N	Y	4.4
Kellogg Biol Stn	232660	Y	N	W	N	Y	5.0
Pine River	235340	Y	N	W	N	Y	10.0
Marcell Stn	241660	Y	N	S	N	N	6.0
Fernburg Stn	241840	Y	N	NW	N	N	10.0
Camp Ripley	242360	Y	N	SW	N	Y	6.0
SW Experimental Stn	242720	Y	N	N	Y	Y	5.0
Clinton	251080	Y	N	E	N	Y	6.7
Meridian	251460	Y	N	E	N	Y	16.8
Coffeeville	253000	Y	N	E	Y	Y	4.9
Ashland Wildlife	260380	Y	N	W	N	Y	6.3
University Forest	260560	Y	N	W	N	Y	2.9
Custer Battlefield	270060	Y	N	E	N	Y	7.6
St Mary Ranger Stn	270560	^	^	^	N	Y	^
Glacier NP FWS	270570	Y	N	W	N	Y	4.5
Havre	270740	Y	N	W	N	Y	5.0
Clancy	270760	Y	Y	W	N	Y	4.0
Give-Out-Morgan	271340	Y	N	S	Y	Y	10.0
Mead	281520	Y	N	W	N	Y	10.0
North Platte	281580	Y	N	W	N	Y	7.2
Red Rock Canyon	290080	Y	N	S	N	Y	3.0
Saval Ranch	290140	Y	N	W	N	Y	5.0
Smith Valley	290360	Y	N	S	N	Y	3.0
Lehman Cave NM	290560	Y	N	W	Y	Y	9.0
Hubbard Brook	300240	N	Y	SSW	N	Y	5.0
Washington Crossing	312980	Y	N	W	N	Y	5.0
Gila Cliff	320180	Y	N	N	N	Y	5.2

TABLE 4, PAGE 1 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Collector Height Standard	Collector on Platform	Wet Bucket Orientation	Ground Slope > 15	Collector Base Open	Collector-Gauge Separation (m)
Bandelier	320720	Y	N	S	N	Y	2.1
Mayhill	320840	Y	N	W	Y	Y	5.8
Cuba NM	320980	Y	N	W	N	Y	3.6
Capulin Mountain	321280	Y	N	E	N	Y	5.5
Aurora	330860	Y	N	W	N	Y	5.0
Chautauqua	331000	N	Y	E	N	Y	1.0
Huntington	332020	Y	N	W	N	Y	7.5
Whiteface Mtn	332020	Y	N	N	Y	Y	10.0
West Point	335141	Y	N	W	N	Y	5.6
Bennett Bridge	335240	N	Y	SSE	N	Y	1.2
Jasper	336500	Y	N	W	N	Y	7.7
Biscuit Brook	336840	N	Y	WSW	N	Y	5.0
Lewiston	340320	Y	N	SE	N	Y	2.2
Coweeta	342500	Y	N	E	N	Y	5.2
Piedmont Res Stn	343460	Y	N	W	N	Y	5.3
Clinton Crops	343560	Y	N	W	N	Y	6.7
Jordan Creek	343600	Y	N	WNW	N	Y	3.7
Finley Farm	344160	Y	N	W	N	Y	3.0
Clingman's Peak	344500	N	Y	W	Y	Y	5.5
T.R. National Park	350700	Y	N	W	Y	Y	4.0
Icelandic State Pk	350880	Y	N	W	N	Y	6.0
Woodworth	351180	Y	N	W	N	Y	6.0
Oxford	360900	Y	N	W	N	Y	5.0
Delaware	361760	Y	N	E	N	Y	5.1
Caldwell	364900	Y	N	W	Y	Y	1.2
Wooster	367160	Y	N	N	N	Y	1.2
Salt Plain NWR	370060	Y	N	W	Y	Y	6.4
Great Plains	371740	Y	N	W	N	Y	6.7
Clayton Lake	372580	Y	N	W	N	Y	5.8
Goodwell	372920	Y	N	W	N	Y	5.5
Alsea Guard	380200	Y	N	W	N	Y	2.0
Hyslop Farm	380202	Y	N	W	N	Y	4.1
Bull Run	380260	N	Y	W	Y	Y	5.3
Silver Lake	380980	Y	N	W	N	Y	5.0
Andrews Forest	381020	N	Y	W	N	Y	7.3

TABLE 4, PAGE 1 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Collector Height Standard	Collector on Platform	Wet Bucket Orientation	Ground Slope > 15	Collector Base Open	Collector-Gauge Separation (m)
Vines Hill	381120	Y	N	W	Y	N	1.5
Starkey Exp Stn	381800	N	Y	W	N	Y	7.6
Penn State	391520	Y	N	SW	N	Y	8.0
Kane Exp Forest	392940	Y	N	W	N	Y	5.5
Leading Ridge	394200	Y	N	W	N	Y	7.0
Milford	397220	Y	N	W	N	Y	4.0
El Verde	402020	N	Y	W	N	Y	1.2
Santee NWR	420680	Y	N	W	N	Y	2.4
Clemson	421880	Y	N	N	N	Y	5.0
Huron Well Field	430061	Y	N	W	N	Y	15.0
Cottonwood	430880	Y	N	W	N	Y	10.0
Walker Branch	440040	Y	N	S	N	Y	29.0
Giles Co	441140	Y	N	W	N	Y	5.0
GSMP-Elkmont	441190	Y	N	W	N	Y	3.5
Hatchie NWR	441400	Y	N	S	N	N	4.6
Muleshoe NWR	450250	Y	N	W	N	Y	6.7
Beeville	450350	Y	N	W	N	Y	6.0
K-Bar Big Bend NP	450425	Y	N	W	N	Y	6.7
Attwater	451040	Y	N	NE	N	Y	5.0
Sonora	451650	Y	N	W	N	Y	8.4
Longview	452180	Y	N	W	N	Y	5.0
Guadalupe Mtns NP	452215	Y	N	W	N	Y	5.0
Forest Seed	453800	Y	N	E	N	Y	5.0
Throckmorton	455180	Y	N	W	N	Y	5.5
Victoria	455350	Y	N	E	N	Y	0.8
LBJ Nat Grassland	455640	Y	N	S	N	Y	3.6
Bryce Canyon	460110	Y	N	W	Y	Y	5.0
Logan	460120	Y	N	W	N	N	5.0
Green River	460281	Y	N	W	N	Y	5.5
Bennington	470100	Y	N	NE	N	Y	1.3
Underhill	470180	N	Y	W	Y	Y	5.2
Charlottesville	480060	Y	N	W	N	Y	6.0
Horton Stn	481300	N	Y	^	Y	Y	4.8
Big Meadows	482890	Y	N	W	N	N	6.0
Loves Mill	483300	Y	N	W	N	Y	5.2

TABLE 4, PAGE 1 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Collector Height Standard	Collector on Platform	Wet Bucket Orientation	Ground Slope > 15	Collector Base Open	Collector-Gauge Separation (m)
Olympic NP	491410	Y	N	W	N	Y	19.5
Sullivan Lake	491540	Y	N	E	N	Y	4.6
Marblemount	491940	Y	N	W	N	Y	4.3
La Grande	492180	Y	N	NW	Y	Y	4.3
Palouse Farm	492420	Y	N	W	N	Y	5.5
Babcock State Park	500460	N	N	N	N	Y	5.1
Parsons	501860	Y	N	WNW	N	Y	5.6
Suring	512500	Y	N	W	N	Y	5.0
Lake Dubay	512800	N	Y	W	Y	Y	2.0
Trout Lake	513640	Y	N	W	N	Y	6.0
Lake Geneva	513680	Y	N	W	N	Y	6.0
Spooner	513700	Y	N	W	N	Y	7.0
Snowy Range	520020	N	Y	W	N	Y	4.9
Sinks Canyons	520260	Y	N	W	N	Y	6.5
South Pass	520261	N	Y	W	N	Y	6.7
Pinedale	520680	Y	N	W	Y	Y	5.0
Gypsum Creek	520681	N	Y	W	Y	Y	10.0
Newcastle	520820	Y	N	W	N	Y	6.0
Tower YNP	520860	Y	N	W	N	Y	6.0
American Samoa	530190	N	Y	W	Y	Y	1.2

TABLE 4, PAGE 2. SITING CRITERIA SURVEY RESULTS

Site Name	ID	Collector-Gauge Heights OK	Snow Roof	Vegetation > 2 ft High	45 Degrees Rule Violation	Storage or Lots < 100 m	Animals < 30 m
Blackbelt	011000	Y	N	N	N	N	Y
Sand Mtn	011020	Y	N	N	N	Y	N
Denali	020390	Y	N	Y	N	N	N
Oliver Knoll	030360	Y	N	Y	N	N	N
Grand Canyon	030370	Y	N	N	N	N	N
Organ Pipe Cactus	030620	Y	N	Y	Y	N	N
Warren	040260	Y	N	N	N	N	N
Caddo Valley	040380	Y	N	N	N	N	N
Buffalo NR	041620	Y	Y	N	N	N	N
Fayetteville	042700	N	N	N	N	N	N
Tanbark Flat	054200	N	N	N	N	N	N
Hopland	054540	Y	N	N	N	N	Y
Palomar	056820	Y	N	N	N	N	N
Sequoia	057550	Y	Y	Y	Y	N	N
Montague	057680	Y	N	N	N	N	N
Chuchupate	058501	Y	N	Y	N	Y	N
Davis	058840	Y	N	N	N	N	N
Yosemite	058850	N	N	N	N	N	N
Alamosa	060060	Y	N	N	N	N	N
Las Animas	060180	Y	N	Y	N	N	N
Niwot Saddle	060220	Y	N	N	N	N	N
Mesa Verde	061530	Y	Y	N	N	N	N
Sand Spring	061560	Y	Y	N	N	N	N
Rocky Mtn Nat Park	061910	Y	N	N	N	N	N
Loch Vale	061911	Y	Y	N	N	N	N
Buffalo Pass	061920	Y	Y	N	N	N	N
Manitou	062120	Y	Y	N	N	N	N
Pawnee	062220	Y	N	N	N	N	Y
Bradford Ft	100360	Y	N	N	N	N	N
CIFANT	100380	Y	N	N	N	N	N
Everglades	101190	Y	N	N	N	Y	N
Quincy	101400	Y	N	N	N	N	Y
Verna Well	104100	Y	N	N	N	N	N
Bellville	112040	Y	N	N	^	^	^
Ft Frederica	112380	Y	N	N	N	N	N

TABLE 4, PAGE 2 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Collector-Gauge Heights OK	Snow Roof	Vegetation > 2 ft High	45 Degrees Rule Violation	Storage or Lots < 100 m	Animals < 30 m
Georgia Stn	114140	Y	N	N	N	N	N
Tifton ARS	115000	Y	N	N	^	^	^
Mauna Loa	120080	Y	N	N	N	N	N
Craters of the Moon	130343	N	Y	Y	N	N	N
Headquarters	130480	Y	N	N	N	N	N
Reynold's Creek	131180	N	N	N	N	Y	N
Smith's Ferry	131500	Y	N	N	N	N	N
Bondville	141160	Y	N	N	N	N	N
Shabbona	141800	Y	N	N	N	N	Y
Argonne	141980	Y	N	N	N	N	N
Southern Il Univ	143580	Y	N	N	N	N	N
Salem	144740	Y	Y	N	N	N	N
Dixon Springs	146340	N	N	N	N	N	N
Monmouth	147860	Y	N	N	N	N	N
Huntington Res	152020	Y	N	N	N	Y	N
SW Purdue Ag Ctr	152260	Y	N	N	N	N	Y
Indiana Dunes	153421	N	N	N	N	Y	N
Purdue U Ag Farm	154100	Y	N	N	N	Y	N
Big Springs	160880	Y	N	N	N	N	N
McNay Research Stn	162320	Y	N	N	N	N	N
Farlington	170740	Y	N	N	N	N	N
Konza Prairie	173120	N	N	N	N	N	N
Lake Scott	173280	Y	N	N	N	N	N
Perryville	180360	Y	N	N	N	N	N
LC Woods	182260	Y	N	N	N	N	N
Clark State	183560	Y	N	N	N	N	N
Land Btwn the Lakes	183860	Y	N	N	N	N	N
Hill Farm	190620	Y	N	N	N	N	N
Iberia	191260	Y	N	N	N	N	Y
SE Research Stn	193060	N	N	N	N	N	N
Acadia	200011	Y	N	N	N	N	N
Caribou	200045	N	N	N	N	Y	N
Presque Isle	200046	Y	N	N	N	Y	N
Bridgton	200275	Y	N	Y	N	N	N
Greenville	200935	Y	N	N	N	Y	N

TABLE 4, PAGE 2 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Collector-Gauge Heights OK	Snow Roof	Vegetation > 2 ft High	45 Degrees Rule Violation	Storage or Lots < 100 m	Animals < 30 m
White Rock	210360	Y	N	N	N	N	N
Wye	211320	Y	N	N	N	N	N
NACL	220155	Y	N	Y	N	N	N
Cadwell Creek	220815	Y	Y	Y	N	N	N
East	221325	Y	Y	N	N	N	N
U of MI Biol Stn	230920	Y	N	N	N	N	N
Raco	230980	Y	N	N	N	N	N
Houghton	232241	Y	Y	Y	N	N	N
Isle Royale NP	232571	Y	N	Y	N	N	N
Kellogg Biol Stn	232660	Y	N	N	N	N	N
Pine River	235340	Y	Y	N	N	N	N
Marcell Stn	241660	Y	Y	N	Y	N	N
Fernburg Stn	241840	Y	Y	N	N	N	N
Camp Ripley	242360	Y	N	Y	Y	N	N
SW Experimental Stn	242720	Y	N	N	N	N	N
Clinton	251080	Y	N	N	N	Y	N
Meridian	251460	Y	N	N	Y	Y	N
Coffeeville	253000	Y	N	Y	Y	Y	N
Ashland Wildlife	260380	Y	N	Y	Y	N	N
University Forest	260560	Y	N	N	N	N	N
Custer Battlefield	270060	Y	N	N	N	N	N
St Mary Ranger Stn	270560	^	N	N	N	N	N
Glacier NP FWS	270570	Y	Y	N	Y	N	Y
Havre	270740	Y	N	N	N	N	N
Clancy	270760	Y	N	N	N	N	N
Give-Out-Morgan	271340	Y	N	N	N	N	N
Mead	281520	Y	N	N	N	Y	N
North Platte	281580	Y	N	Y	N	N	N
Red Rock Canyon	290080	Y	N	N	N	N	N
Saval Ranch	290140	Y	N	Y	N	N	Y
Smith Valley	290360	Y	N	N	N	N	N
Lehman Cave NM	290560	Y	N	Y	N	N	N
Hubbard Brook	300240	N	Y	N	N	N	N
Washington Crossing	312980	Y	N	N	N	N	N
Gila Cliff	320180	Y	N	N	Y	Y	N

TABLE 4, PAGE 2 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Collector-Gauge Heights OK	Snow Roof	Vegetation > 2 ft High	45 Degrees Rule Violation	Storage or Lots < 100 m	Animals < 30 m
Bandelier	320720	Y	N	Y	N	N	N
Mayhill	320840	Y	N	N	N	Y	Y
Cuba NM	320980	Y	N	N	N	N	Y
Capulin Mountain	321280	Y	N	N	N	N	N
Aurora	330860	Y	N	Y	Y	N	N
Chautauqua	331000	Y	Y	N	N	N	N
Huntington	332020	Y	Y	Y	N	N	N
Whiteface Mtn	332020	N	N	N	N	N	N
West Point	335141	Y	N	N	N	N	N
Bennett Bridge	335240	Y	Y	Y	N	N	N
Jasper	336500	Y	Y	N	N	N	N
Biscuit Brook	336840	Y	Y	N	N	N	N
Lewiston	340320	Y	N	N	N	Y	N
Coweeta	342500	Y	N	N	N	N	N
Piedmont Res Stn	343460	Y	N	N	N	N	N
Clinton Crops	343560	Y	N	N	N	N	N
Jordan Creek	343600	Y	N	N	N	N	N
Finley Farm	344160	Y	N	N	N	N	N
Clingman's Peak	344500	Y	N	Y	N	N	N
T.R. National Park	350700	Y	N	N	N	N	Y
Icelandic State Pk	350880	Y	N	Y	N	N	N
Woodworth	351180	Y	N	Y	N	N	Y
Oxford	360900	Y	N	N	N	N	N
Delaware	361760	Y	N	N	N	N	N
Caldwell	364900	Y	N	Y	N	N	Y
Wooster	367160	Y	N	N	N	N	N
Salt Plain NWR	370060	N	N	N	N	N	N
Great Plains	371740	^	N	Y	N	Y	Y
Clayton Lake	372580	Y	N	N	N	N	N
Goodwell	372920	N	N	N	N	N	^
Alsea Guard	380200	Y	N	N	Y	Y	N
Hyslop Farm	380202	Y	N	N	Y	Y	N
Bull Run	380260	Y	N	N	N	N	N
Silver Lake	380980	Y	N	N	N	N	Y
Andrews Forest	381020	Y	N	Y	N	N	N

TABLE 4, PAGE 2 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Collector-Gauge Heights OK	Snow Roof	Vegetation > 2 ft High	45 Degrees Rule Violation	Storage or Lots < 100 m	Animals < 30 m
Vines Hill	381120	N	N	N	N	N	Y
Starkey Exp Stn	381800	N	N	N	N	N	Y
Penn State	391520	N	N	N	Y	N	N
Kane Exp Forest	392940	Y	N	N	N	N	N
Leading Ridge	394200	Y	Y	N	N	N	N
Milford	397220	Y	Y	N	N	N	N
El Verde	402020	Y	N	Y	N	N	N
Santee NWR	420680	Y	N	N	N	N	N
Clemson	421880	Y	Y	N	N	N	Y
Huron Well Field	430061	N	N	N	N	N	Y
Cottonwood	430880	Y	N	N	N	N	Y
Walker Branch	440040	N	N	N	N	N	N
Giles Co	441140	Y	N	N	N	N	N
GSMP-Elkmont	441190	Y	N	N	Y	N	N
Hatchie NWR	441400	Y	N	Y	N	N	N
Muleshoe NWR	450250	Y	N	N	N	N	N
Beeville	450350	Y	N	N	N	N	Y
K-Bar Big Bend NP	450425	Y	N	N	N	N	N
Attwater	451040	Y	N	N	N	N	N
Sonora	451650	Y	N	N	N	N	Y
Longview	452180	Y	N	N	N	N	N
Guadalupe Mtns NP	452215	Y	N	N	N	N	N
Forest Seed	453800	Y	N	N	N	N	N
Throckmorton	455180	Y	N	N	N	N	^
Victoria	455350	Y	N	Y	N	Y	N
LBJ Nat Grassland	455640	N	N	Y	N	Y	N
Bryce Canyon	460110	Y	N	N	N	N	N
Logan	460120	Y	N	N	N	N	Y
Green River	460281	Y	N	N	N	N	N
Bennington	470100	Y	Y	N	N	N	N
Underhill	470180	Y	Y	N	N	N	N
Charlottesville	480060	Y	N	N	N	N	N
Horton Stn	481300	Y	Y	Y	Y	N	N
Big Meadows	482890	Y	Y	N	N	N	N
Loves Mill	483300	Y	N	N	N	N	Y

TABLE 4, PAGE 2 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Collector-Gauge Heights OK	Snow Roof	Vegetation > 2 ft High	45 Degrees Rule Violation	Storage or Lots < 100 m	Animals < 30 m
Olympic NP	491410	Y	N	N	Y	Y	N
Sullivan Lake	491540	Y	N	N	N	N	N
Marblemount	491940	N	N	Y	N	N	N
La Grande	492180	Y	N	Y	N	N	N
Palouse Farm	492420	Y	N	N	Y	N	^
Babcock State Park	500460	N	N	N	Y	N	N
Parsons	501860	Y	N	N	N	Y	N
Suring	512500	Y	N	N	N	N	N
Lake Dubay	512800	Y	Y	N	N	N	N
Trout Lake	513640	Y	Y	N	N	N	N
Lake Geneva	513680	Y	N	Y	N	N	N
Spooner	513700	Y	Y	N	N	N	N
Snowy Range	520020	Y	Y	N	N	N	N
Sinks Canyons	520260	Y	N	N	N	N	N
South Pass	520261	Y	Y	N	N	N	N
Pinedale	520680	Y	N	N	N	N	N
Gypsum Creek	520681	N	N	N	N	N	Y
Newcastle	520820	Y	N	Y	N	N	N
Tower YNP	520860	Y	Y	N	N	N	N
American Samoa	530190	^	N	Y	N	N	N

TABLE 4, PAGE 3. SITING CRITERIA SURVEY RESULTS

Site Name	ID	Feedlots < 500 m	Transit Sources < 100 m	Industry < 10 km	Upwind Industry < 20 km	Urban Area < 10 km	Upwind Urban Area < 20 km
Blackbelt	011000	Y	N	N	N	N	N
Sand Mtn	011020	N	Y	N	N	N	N
Denali	020390	N	N	N	N	N	N
Oliver Knoll	030360	Y	N	N	N	N	N
Grand Canyon	030370	N	N	Y	N	N	N
Organ Pipe Cactus	030620	Y	N	N	N	Y	Y
Warren	040260	N	N	Y	N	N	N
Caddo Valley	040380	N	N	N	N	N	N
Buffalo NR	041620	N	N	N	N	N	N
Fayetteville	042700	Y	Y	Y	^	Y	N
Tanbark Flat	054200	N	N	N	Y	N	Y
Hopland	054540	Y	N	N	N	N	N
Palomar	056820	N	N	N	N	N	N
Sequoia	057550	N	N	N	N	N	N
Montague	057680	N	N	N	N	N	N
Chuchupate	058501	N	Y	Y	Y	N	N
Davis	058840	N	N	Y	N	Y	Y
Yosemite	058850	N	N	N	N	N	N
Alamosa	060060	N	N	N	N	Y	N
Las Animas	060180	N	N	N	N	N	N
Niwot Saddle	060220	N	N	N	N	N	N
Mesa Verde	061530	N	N	N	N	N	N
Sand Spring	061560	N	N	Y	N	N	N
Rocky Mtn Nat Park	061910	N	Y	N	N	Y	N
Loch Vale	061911	N	N	N	N	N	N
Buffalo Pass	061920	N	N	N	N	N	N
Manitou	062120	N	N	N	N	N	N
Pawnee	062220	N	N	N	N	N	N
Bradford Ft	100360	N	N	N	N	N	N
CIFANT	100380	N	N	Y	N	N	Y
Everglades	101190	N	N	N	N	N	N
Quincy	101400	N	N	N	N	N	N
Verna Well	104100	N	N	N	N	N	N
Bellville	112040	^	^	^	^	^	^
Ft Frederica	112380	N	N	N	Y	Y	Y

TABLE 4, PAGE 3 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Feedlots < 500 m	Transit Sources < 100 m	Industry < 10 km	Upwind Industry < 20 km	Urban Area < 10 km	Upwind Urban Area < 20 km
Georgia Stn	114140	N	N	N	N	N	N
Tifton ARS	115000	^	^	^	^	^	^
Mauna Loa	120080	N	N	N	N	N	N
Craters of the Moon	130343	N	N	N	N	N	N
Headquarters	130480	N	N	Y	N	N	N
Reynold's Creek	131180	N	N	N	N	N	N
Smith's Ferry	131500	N	N	N	N	N	N
Bondville	141160	Y	N	Y	N	N	Y
Shabbona	141800	N	N	N	N	N	N
Argonne	141980	N	N	Y	Y	Y	Y
Southern Il Univ	143580	N	Y	N	Y	Y	N
Salem	144740	N	N	Y	Y	N	Y
Dixon Springs	146340	N	N	N	N	N	N
Monmouth	147860	N	N	Y	N	N	N
Huntington Res	152020	Y	N	Y	N	Y	Y
SW Purdue Ag Ctr	152260	N	N	N	N	N	N
Indiana Dunes	153421	N	N	Y	Y	Y	Y
Purdue U Ag Farm	154100	N	N	N	N	N	N
Big Springs	160880	N	Y	N	N	N	N
McNay Research Stn	162320	N	Y	N	N	N	N
Farlington	170740	N	N	N	N	N	N
Konza Prairie	173120	N	N	N	N	N	N
Lake Scott	173280	N	N	N	N	N	N
Perryville	180360	N	N	N	N	N	N
LC Woods	182260	N	N	N	N	N	N
Clark State	183560	N	N	N	N	N	N
Land Btwn the Lakes	183860	N	N	N	N	N	N
Hill Farm	190620	Y	N	Y	N	N	N
Iberia	191260	Y	N	Y	Y	N	N
SE Research Stn	193060	N	N	Y	N	N	N
Acadia	200011	N	Y	Y	N	Y	N
Caribou	200045	N	Y	N	N	Y	Y
Presque Isle	200046	N	N	N	^	^	^
Bridgton	200275	Y	N	N	N	N	N
Greenville	200935	N	N	Y	N	N	N

TABLE 4, PAGE 3 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Feedlots < 500 m	Transit Sources < 100 m	Industry < 10 km	Upwind Industry < 20 km	Urban Area < 10 km	Upwind Urban Area < 20 km
White Rock	210360	N	N	N	N	N	N
Wye	211320	N	N	N	N	N	N
NACL	220155	N	N	N	N	N	N
Cadwell Creek	220815	N	N	N	N	N	N
East	221325	N	Y	N	N	Y	Y
U of MI Biol Stn	230920	N	N	N	N	N	N
Raco	230980	N	N	N	N	N	N
Houghton	232241	N	N	Y	N	Y	N
Isle Royale NP	232571	N	Y	N	N	N	N
Kellogg Bio Stn	232660	N	N	N	N	N	N
Pine River	235340	N	N	N	N	N	N
Marcell Stn	241660	N	N	N	N	N	N
Fernburg Stn	241840	N	N	N	N	N	N
Camp Ripley	242360	N	N	N	N	N	N
SW Experimental Stn	242720	Y	Y	Y	Y	N	N
Clinton	251080	N	N	Y	Y	Y	Y
Meridian	251460	N	Y	Y	Y	Y	Y
Coffeeville	253000	N	N	N	N	N	N
Ashland Wildlife	260380	Y	N	N	N	N	N
University Forest	260560	N	N	N	N	N	N
Custer Battlefield	270060	N	N	N	N	N	N
St Mary Station	270560	N	N	Y	N	N	N
Glacier NP FWS	270570	Y	N	Y	N	N	N
Havre	270740	N	N	N	N	N	N
Clancy	270760	N	N	N	N	N	N
Give-Out-Morgan	271340	N	N	Y	N	N	N
Mead	281520	N	N	N	N	N	N
North Platte	281580	N	N	N	N	Y	Y
Red Rock Canyon	290080	N	N	N	N	N	Y
Saval Ranch	290140	N	N	N	^	N	N
Smith Valley	290360	N	N	N	N	N	N
Lehman Cave	290560	N	N	N	N	N	N
Hubbard Brook	300240	N	N	N	Y	N	N
Washington Crossing	312980	N	N	N	Y	N	Y
Gila Cliff	320180	Y	N	N	N	N	N

TABLE 4, PAGE 3 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Feedlots < 500 m	Transit Sources < 100 m	Industry < 10 km	Upwind Industry < 20 km	Urban Area < 10 km	Upwind Urban Area < 20 km
Bandelier	320720	N	N	N	N	N	Y
Mayhill	320840	N	N	N	N	N	N
Cuba NM	320980	N	N	N	N	N	N
Capulin Mountain	321280	N	N	N	N	N	N
Aurora	330860	N	N	N	N	N	N
Chautauqua	331000	N	N	N	N	N	N
Huntington	332020	N	N	N	N	N	N
Whiteface Mtn	332020	N	N	N	N	N	N
West Point	335141	N	N	N	Y	N	Y
Bennett Bridge	335240	N	N	N	N	N	N
Jasper	336500	N	N	N	N	N	N
Biscuit Brook	336840	N	N	N	N	N	N
Lewiston	340320	N	Y	N	N	N	N
Coweeta	342500	N	N	N	N	N	N
Piedmont Res Stn	343460	Y	N	Y	N	N	Y
Clinton Crops	343560	N	N	Y	Y	N	N
Jordan Creek	343600	N	N	N	N	N	N
Finley Farm	344160	N	N	N	N	Y	N
Clingman's Peak	344500	N	N	N	N	N	N
T.R. National Park	350700	N	N	N	N	N	N
Icelandic State Pk	350880	N	N	N	N	N	N
Woodworth	351180	Y	Y	N	N	N	N
Oxford	360900	N	N	N	N	N	N
Delaware	361760	N	N	N	N	Y	Y
Caldwell	364900	Y	N	Y	N	N	N
Wooster	367160	Y	N	Y	^	Y	N
Salt Plain NWR	370060	Y	N	N	N	N	N
Great Plains	371740	Y	N	Y	N	N	Y
Clayton Lake	372580	N	N	N	N	N	N
Goodwell	372920	Y	N	Y	Y	N	Y
Alsea Guard	380200	N	Y	Y	N	N	N
Hyslop Farm	380202	N	Y	N	Y	Y	Y
Bull Run	380260	N	N	N	N	N	N
Silver Lake	380980	N	N	N	N	N	N
Andrews Forest	381020	N	Y	N	N	N	N

TABLE 4, PAGE 3 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Feedlots < 500 m	Transit Sources < 100 m	Industry < 10 km	Upwind Industry < 20 km	Urban Area < 10 km	Upwind Urban Area < 20 km
Vines Hill	381120	N	N	N	N	N	N
Starkey Exp Stn	381800	N	N	N	N	N	N
Penn State	391520	N	N	Y	N	Y	Y
Kane Exp Forest	392940	N	N	N	Y	N	N
Leading Ridge	394200	N	N	N	N	N	N
Milford	397220	N	N	N	N	N	N
El Verde	402020	N	N	N	N	N	N
Santee NWR	420680	N	N	N	N	N	N
Clemson	421880	Y	N	Y	Y	N	N
Huron Well Field	430061	Y	^	Y	N	Y	N
Cottonwood	430880	Y	N	N	N	N	N
Walker Branch	440040	N	N	Y	Y	Y	Y
Giles Co	441140	Y	N	N	Y	N	N
GSMP-Elkmont	441190	N	N	N	N	N	N
Hatchie NWR	441400	N	N	N	N	N	N
Muleshoe NWR	450250	Y	N	N	N	N	N
Beeville	450350	N	N	N	N	N	N
K-Bar Big Bend NP	450425	N	N	N	N	N	N
Attwater	451040	N	N	N	N	N	N
Sonora	451650	Y	N	Y	N	N	N
Longview	452180	N	N	Y	Y	N	N
Guadalupe Mtns NP	452215	N	N	N	N	N	N
Forest Seed	453800	N	N	N	N	N	N
Throckmorton	455180	N	N	N	N	N	^
Victoria	455350	N	N	N	N	Y	^
LBJ Nat Grassland	455640	Y	N	N	N	N	N
Bryce Canyon	460110	N	N	Y	N	N	N
Logan	460120	Y	N	Y	N	N	Y
Green River	460281	N	N	Y	N	N	N
Bennington	470100	N	N	Y	Y	Y	Y
Underhill	470180	N	N	N	N	N	N
Charlottesville	480060	N	N	^	^	N	Y
Horton Stn	481300	N	N	N	N	N	N
Big Meadows	482890	N	N	N	N	N	N
Loves Mill	483300	Y	N	N	N	N	N

TABLE 4, PAGE 3 (cont). SITING CRITERIA SURVEY RESULTS

Site Name	ID	Feedlots < 500 m	Transit Sources < 100 m	Industry < 10 km	Upwind Industry < 20 km	Urban Area < 10 km	Upwind Urban Area < 20 km
Olympic NP	491410	N	Y	N	N	N	N
Sullivan Lake	491540	N	N	N	N	N	N
Marblemount	491940	N	N	N	N	N	N
La Grande	492180	N	N	N	N	N	N
Palouse Farm	492420	N	N	N	N	Y	N
Babcock State Park	500460	N	N	N	N	N	N
Parsons	501860	N	N	Y	Y	N	N
Suring	512500	N	N	N	N	N	N
Lake Dubay	512800	N	N	N	N	N	N
Trout Lake	513640	N	N	N	N	N	N
Lake Geneva	513680	N	N	N	N	N	N
Spooner	513700	N	N	N	N	N	N
Snowy Range	520020	N	N	N	N	N	N
Sinks Canyons	520260	N	N	N	N	N	N
South Pass	520261	N	N	N	N	N	N
Pinedale	520680	N	N	N	N	N	N
Gypsum Creek	520681	N	N	N	N	N	N
Newcastle	520820	Y	N	Y	Y	N	N
Tower YNP	520860	Y	N	N	N	N	N
American Samoa	530190	N	N	N	N	N	N

above snow packs which could exceed 10 feet. One collector (El Verde) was located on a 60 ft tower for sampling above the forest canopy. Only two collectors (Horton Station and Clingman's Peak) were located on building roofs. The Horton Station site has since been moved.

The effect of shorter platforms on the sample is believed to be minimal. For those samples located on the tops of buildings or tall towers, it is not clear what the effect may be. Enclosed collector bases could produce turbulence during strong winds which might affect collection efficiency. The removal of collector base enclosures was recommended.

Wet Bucket Orientation

The collector should be mounted with the wet side bucket to the West and the sensor facing North. In this way, the wet bucket is generally upwind of the dry side bucket (winds generally being from the S to SW in the eastern United States), and the sensor is downwind of the wet side bucket. This placement is designed to lessen the chance for contamination and to minimize the obstruction of the collector itself to sample entry.

One hundred and forty collectors (72%) were correctly installed with the wet bucket facing to the SW, W, or NW. Seventeen were found installed with the wet bucket facing S. These southerly installations probably have no effect on the data. Thirty-seven collectors that are installed with the collection bucket facing N or E may cause an aberration in the collection efficiency or sample chemistry. A statistical study of the long-term data base would be required to discern this and may be complicated by other factors. It is recommended that all collectors be oriented with the wet bucket facing West and the sensor facing North. The date this change occurs must be documented and accompany the data base.

Ground Slope

The collector should not be located on ground with a slope greater than 15 degrees or 27 percent. The slope at 33 sites (17% of the total) exceeded this criterion. All of these sites were located in mountainous regions and the sites were representative of their respective regions.

It is difficult to say what the effect of the steeper slopes is on collection efficiencies. However, to adhere too rigidly to the criterion would effectively eliminate many regions, especially higher elevations, from this network.

Collector and Rain Gauge at Same Height

The heights above ground of the collection bucket and the rain gauge orifice should be within 1 foot of each other. Twenty-two sites (11%) did not meet this criterion. However, in all cases, the criterion was exceeded by small amounts and the effect on the database is probably negligible.

Distance from Rain Gauge

The collector should be located within a distance of 30 m of the rain gauge but no closer than 5 m. This guideline is set so that the collector and gauge "see" the same precipitation event and so that neither piece of equipment offers an aerodynamic interference to the other's collection ability.

Fifty-eight sites (30%) had rain gauges less than 4.9 m from the collector. The collector and rain gauge were mounted on a platform at 23 of these sites and separating them would require the construction of a second platform (one site had separate platforms). Some sites not meeting the distance requirement were enclosed by chain link fences for security; meeting the distance requirement for these sites would require enlarging the enclosures or building a separate one. Many sites in this network may not be able to comply with this criterion due to cost. However, those gauges which can be moved to the proper distance should be and the move should be documented. None of the sites exceeded the recommended separation distance of 30 m.

Snow Roof

Collectors in areas that normally receive snow should have a properly counterweighted snow roof installed on the moving lid of the collector. Thirty-four collectors (17%) were equipped with snow roofs. All snow roofs were installed correctly to deflect water away from the wet bucket during lid motion. Snow roofs were only found at sites where their use was indicated.

Site Surroundings

Included in Table 4 are the site evaluation results relative to criteria addressing potential pollutant sources. The NADP/NTN criteria are intended to minimize the chances that precipitation data will be biased by local sources.

Industry and Urban Areas -- A site should not be located within 10 km of an industry or urban area or within 20 km of an upwind industry or urban area. The intent here is avoid the potentially large bias which could result from a nearby power plant, city, or other major pollutant source so that the site data will be representative of a region. Fifty-four sites (28%) were too close to industries and forty-two sites (22%) were too near cities with respect to the siting criteria. The impact of these influences will vary considerably across the affected sites for several reasons. Obviously the amount of pollutant released will vary considerably from source to source. In addition, the bias created by a nearby source will be relative to the normal background levels of the region. For these and other reasons, it is difficult to assess the impact of these siting criteria variances on the data base.

Grazing Animals or Feedlots -- The site should be more than 30 m from grazing animals and more than 500 m from large concentrations of animals such as feedlots, dairy farms, or poultry farms. These criteria are intended to keep sources of compounds which could buffer acidic solutions removed from the site. Sixteen of the sites were only affected by grazing animals and the effect here is probably negligible since animals in these situations tend to roam over large areas and are not concentrated near the site. Thirty-one of the sites (16%), however, were near large concentrations of animals which could affect the sample chemistry.

Vegetation within 30 m and the 45 Degree Rule -- Vegetation within 30 m of the collector should not be more than two feet tall and no object should project on the collector from an angle greater than 45 degrees. These criteria are intended to keep windblown contaminants such as seeds or splashing water out of the collection bucket. Forty-nine sites (25%) failed to meet one or both criteria. The most frequent source of violation found was broomstraw at or just above the 2 ft height limit and is not considered a major source of sample bias. Eighteen sites (9%) had trees or meteorological towers too near the collectors. Under certain wind conditions, it is possible that rain splashing from these objects into the collection bucket could significantly alter the sample chemistry.

Parking Lots, Transit Sources, or Chemical Storage -- The site should not be within 100 m of chemical storage facilities parking lots, or transit sources, such as well traveled roads, railroads and shipping channels. Thirty-six sites (18%) did not satisfy these criteria.

EQUIPMENT AND SAMPLE COLLECTION SURVEY

System and performance checks were made at each site to assess the operational fitness of the Aerochem Metrics precipitation collector and the Belfort rain gauge. The process of sample retrieval and care was also examined. These are discussed below.

Precipitation Collector System Checks

Given below is a discussion of precipitation collector system checks. Refer to Table 5.

Collector Level

The precipitation collector should be level so that the collection efficiency will not be biased by wind direction or variations in effective bucket opening areas. Only 13 collectors (7%) were not level. In all cases the collectors were off level by small amounts. It is not believed the effect of this variance would be measurable.

Collector Stable

The precipitation collector should be mounted firmly so that it will not move in strong winds. Only three collectors were unstable (i.e. could be rocked easily by hand).

Sensor Clean

The collector's sensor should be clean. Only six collector sensors were dirty; five as the result of bird droppings. The usual effect of a dirty sensor is to prolong the length of time the wet bucket stays uncovered after an event, increasing the likelihood of contamination. Bird droppings are a continuing problem and these five instances were the result of recent droppings, not poor maintenance. The sensor at the sixth site had substantial deposits of salts on the sensor grid indicating poor maintenance.

TABLE 5. AEROCHEM METRICS COLLECTOR SYSTEM CHECKS

Site Name	ID	Power Type *	Collector Level	Collector Stable	Sensor Clean	Bucket Tie-down Used	Correct Counter-Weight	Clutch Worn
Blackbelt	011000	E	Y	Y	Y	N	^	N
Sand Mtn	011020	A	Y	Y	Y	N	^	N
Denali	020390	A	Y	Y	Y	Y	Y	Y
Oliver Knoll	030360	C	Y	Y	Y	Y	Y	N
Grand Canyon	030370	A	Y	Y	Y	Y	Y	N
Organ Pipe Cactus	030620	B	^	Y	Y	Y	Y	N
Warren	040260	A	Y	Y	N	N	Y	N
Caddo Valley	040380	A	Y	Y	Y	Y	Y	N
Buffalo NR	041620	B	Y	Y	N	Y	Y	N
Fayetteville	042700	A	Y	Y	Y	Y	Y	N
Tanbark Flat	054200	B	Y	Y	Y	Y	Y	N
Hopland	054540	A	Y	Y	Y	Y	Y	N
Palomar	056820	A	Y	Y	Y	Y	Y	N
Sequoia	057550	A	Y	Y	Y	Y	Y	Y
Montague	057680	B	Y	Y	Y	Y	Y	N
Chuchupate	058501	B	Y	Y	Y	Y	Y	N
Davis	058840	A	Y	Y	Y	Y	Y	N
Yosemite	058850	A	Y	Y	Y	N	Y	N
Alamosa	060060	A	Y	Y	Y	Y	Y	N
Las Animas	060180	B	Y	Y	Y	Y	Y	N
Niwot Saddle	060220	F	Y	Y	Y	Y	Y	N
Mesa Verde	061530	A	N	Y	Y	Y	Y	N
Sand Spring	061560	E	Y	Y	Y	Y	Y	N
Rocky Mtn Nat Park	061910	A	Y	Y	Y	Y	Y	N
Loch Vale	061911	E	Y	Y	Y	Y	Y	N
Buffalo Pass	061920	B	Y	Y	Y	Y	Y	N
Manitou	062120	A	Y	Y	Y	Y	Y	N
Pawnee	062220	B	Y	Y	Y	Y	Y	N
Bradford Ft	100360	E	N	Y	Y	^	Y	N
CIFANT	100380	B	Y	Y	Y	Y	Y	N
Everglades	101190	A	Y	Y	Y	^	Y	N
Quincy	101400	B	Y	Y	Y	N	Y	^
Verna Well	104100	A	Y	Y	Y	N	Y	N
Bellville	112040	C	Y	Y	Y	N	^	Y
Ft Frederica	112380	B	Y	Y	Y	Y	Y	N

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* (A) AC only; (B) AC w/ Aerochem trickle charger/battery; (C) Battery only; (D) Battery w/ external AC powered charger; (E) Solar; (F) Other.

^ Indicates not checked.

TABLE 5 (cont). AEROCHEM METRICS COLLECTOR SYSTEM CHECKS

Site Name	ID	Power Type *	Collector Level	Collector Stable	Sensor Clean	Bucket Tie-down Used	Correct Counter-Weight	Clutch Worn
Georgia Stn	114140	B	Y	Y	^	Y	Y	N
Tifton ARS	115000	A	Y	Y	Y	N	Y	N
Mauna Loa	120080	A	Y	Y	Y	Y	Y	N
Craters of the Moon	130343	A	Y	Y	Y	Y	Y	N
Headquarters	130480	B	Y	N	Y	Y	N	Y
Reynold's Creek	131180	A	Y	Y	Y	Y	Y	N
Smith's Ferry	131500	E	Y	Y	Y	Y	Y	N
Bondville	141160	B	Y	Y	Y	Y	Y	N
Shabbona	141800	A	Y	Y	Y	Y	Y	N
Argonne	141980	A	Y	Y	Y	Y	Y	N
Southern Il Univ	143580	A	Y	Y	Y	Y	Y	N
Salem	144740	A	Y	Y	Y	Y	Y	N
Dixon Springs	146340	A	Y	Y	Y	Y	Y	N
Monmouth	147860	A	Y	Y	Y	Y	Y	N
Huntington Res	152020	A	Y	Y	Y	Y	Y	N
SW Purdue Ag Ctr	152260	A	Y	Y	Y	N	Y	N
Indiana Dunes	153421	A	Y	Y	Y	Y	Y	N
Purdue U Ag Farm	154100	A	Y	Y	Y	Y	Y	N
Big Springs	160880	E	Y	Y	Y	Y	Y	N
McNay Research Stn	162320	A	Y	Y	Y	Y	Y	N
Farlington	170740	E	Y	Y	Y	Y	Y	N
Konza Prairie	173120	A	Y	Y	Y	Y	Y	N
Lake Scott	173280	D	^	Y	Y	Y	Y	N
Perryville	180360	C	Y	Y	Y	Y	Y	N
LC Woods	182260	C	Y	Y	Y	N	Y	N
Clark State	183560	E	Y	Y	Y	Y	Y	N
Land Btwn the Lakes	183860	A	Y	Y	Y	Y	Y	Y
Hill Farm	190620	A	Y	Y	Y	Y	Y	N
Iberia	191260	A	Y	Y	Y	Y	Y	N
SE Research Stn	193060	A	Y	Y	Y	Y	Y	N
Acadia	200011	A	Y	Y	Y	N	N	N
Caribou	200045	A	Y	Y	Y	Y	Y	N
Presque Isle	200046	A	Y	Y	Y	Y	Y	N
Bridgton	200275	A	Y	Y	N	Y	Y	Y
Greenville	200935	A	Y	Y	Y	Y	Y	N

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* (A) AC only; (B) AC w/ Aerochem trickle charger/battery; (C) Battery only; (D) Battery w/ external AC powered charger; (E) Solar; (F) Other.

TABLE 5 (cont). AEROCHEM METRICS COLLECTOR SYSTEM CHECKS

Site Name	ID	Power Type *	Collector Level	Collector Stable	Sensor Clean	Bucket Tie-down Used	Correct Counter-Weight	Clutch Worn
White Rock	210360	A	N	Y	Y	Y	Y	N
Wye	211320	B	Y	Y	Y	Y	Y	N
NACL	220155	A	N	Y	Y	Y	Y	N
Cadwell Creek	220815	A	Y	Y	Y	N	Y	Y
East	221325	A	Y	Y	Y	Y	Y	N
U of MI Biol Stn	230920	A	Y	Y	Y	Y	Y	N
Raco	230980	B	Y	Y	Y	Y	Y	Y
Houghton	232241	A	Y	Y	Y	Y	Y	N
Isle Royale NP	232571	C	Y	Y	Y	Y	Y	Y
Kellogg Biol Stn	232660	A	Y	Y	Y	Y	Y	Y
Pine River	235340	A	Y	Y	Y	N	Y	N
Marcell Stn	241660	A	Y	Y	Y	Y	Y	N
Fernburg Stn	241840	A	Y	Y	Y	Y	^	^
Camp Ripley	242360	B	Y	Y	Y	Y	Y	N
SW Experimental Stn	242720	A	Y	Y	Y	Y	Y	N
Clinton	251080	A	Y	Y	Y	N	^	N
Meridian	251460	A	Y	Y	Y	N	^	N
Coffeeville	253000	A	Y	Y	Y	N	^	N
Ashland Wildlife	260380	C	Y	Y	Y	Y	Y	N
University Forest	260560	A	Y	Y	Y	Y	Y	N
Custer Battlefield	270060	E	Y	Y	Y	Y	Y	N
St Mary Ranger Stn	270560	A	^	^	^	^	^	^
Glacier NP FWS	270570	A	Y	Y	Y	Y	Y	Y
Havre	270740	B	Y	Y	Y	Y	Y	Y
Clancy	270760	B	Y	Y	Y	Y	Y	N
Give-Out-Morgan	271340	A	Y	Y	Y	Y	Y	N
Mead	281520	A	Y	Y	Y	Y	Y	N
North Platte	281580	E	Y	Y	Y	Y	Y	N
Red Rock Canyon	290080	C	Y	Y	Y	Y	Y	N
Saval Ranch	290140	A	Y	Y	Y	Y	Y	Y
Smith Valley	290360	E	Y	Y	Y	Y		N
Lehman Cave NM	290560	E	Y	Y	Y	N	Y	N
Hubbard Brook	300240	A	Y	Y	Y	Y	Y	N
Washington Crossing	312980	A	^	Y	Y	Y	Y	N
Gila Cliff	320180	E	Y	Y	Y	Y	Y	N

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* (A) AC only; (B) AC w/ Aerochem trickle charger/battery; (C) Battery only; (D) Battery w/ external AC powered charger; (E) Solar; (F) Other.

TABLE 5 (cont). AEROCHEM METRICS COLLECTOR SYSTEM CHECKS

Site Name	ID	Power Type *	Collector Level	Collector Stable	Sensor Clean	Bucket Tie-down Used	Correct Counter-Weight	Clutch Worn
Bandelier	320720	A	Y	Y	Y	N	Y	N
Mayhill	320840	A	Y	Y	Y	Y	Y	N
Cuba NM	320980	E	Y	Y	Y	Y	Y	N
Capulin Mountain	321280	A	Y	Y	N	Y	N	Y
Aurora	330860	A	Y	Y	Y	Y	^	N
Chautauqua	331000	A	Y	Y	Y	Y	Y	N
Huntington	332020	B	Y	Y	Y	N	Y	N
Whiteface Mtn	332020	A	Y	Y	Y	Y	^	Y
West Point	335141	B	Y	Y	Y	Y	Y	N
Bennett Bridge	335240	A	Y	N	Y	Y	^	Y
Jasper	336500	A	Y	Y	Y	Y	Y	N
Biscuit Brook	336840	A	Y	Y	Y	N	Y	Y
Lewiston	340320	A	Y	Y	Y	Y	Y	N
Coweeta	342500	A	Y	Y	Y	N	Y	N
Piedmont Res Stn	343460	A	Y	Y	Y	Y	Y	Y
Clinton Crops	343560	A	Y	Y	Y	Y	Y	N
Jordan Creek	343600	C	Y	Y	Y	^	^	^
Finley Farm	344160	A	Y	Y	Y	N	Y	Y
Clingman's Peak	344500	B	Y	Y	Y	Y	Y	N
T.R. National Park	350700	A	Y	Y	Y	Y	Y	N
Icelandic State Pk	350880	A	Y	Y	Y	Y	Y	N
Woodworth	351180	A	Y	Y	Y	Y	Y	N
Oxford	360900	A	Y	Y	Y	Y	Y	N
Delaware	361760	A	Y	Y	Y	Y	Y	N
Caldwell	364900	A	N	Y	Y	Y	Y	N
Wooster	367160	A	N	Y	Y	Y	N	N
Salt Plain NWR	370060	E	Y	Y	Y	Y	Y	N
Great Plains	371740	A	Y	Y	Y	Y	^	^
Clayton Lake	372580	C	Y	Y	Y	Y	Y	N
Goodwell	372920	E	Y	Y	Y	Y	Y	N
Alsea Guard	380200	A	N	Y	Y	Y	Y	^
Hyslop Farm	380202	B	Y	Y	Y	Y	Y	N
Bull Run	380260	C	Y	Y	Y	Y	Y	N
Silver Lake	380980	E	N	Y	Y	Y	Y	N
Andrews Forest	381020	A	^	Y	Y	Y	Y	N

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* (A) AC only; (B) AC w/ Aerochem trickle charger/battery; (C) Battery only; (D) Battery w/ external AC powered charger; (E) Solar; (F) Other.

TABLE 5 (cont). AEROCHEM METRICS COLLECTOR SYSTEM CHECKS

Site Name	ID	Power Type *	Collector Level	Collector Stable	Sensor Clean	Bucket Tie-down Used	Correct Counter-Weight	Clutch Worn
Vines Hill	381120	A	Y	Y	Y	Y	Y	N
Starkey Exp Stn	381800	B	Y	Y	Y	Y	Y	N
Penn State	391520	A	Y	Y	Y	Y	Y	N
Kane Exp Forest	392940	B	Y	Y	Y	Y	Y	Y
Leading Ridge	394200	A	Y	Y	Y	Y	Y	Y
Milford	397220	A	Y	Y	Y	N	Y	N
El Verde	402020	B	Y	Y	N	Y	Y	N
Santee NWR	420680	E	Y	Y	Y	N	^	N
Clemson	421880	A	Y	Y	Y	Y	Y	N
Huron Well Field	430061	A	Y	Y	Y	Y	Y	N
Cottonwood	430880	A	Y	Y	Y	Y	Y	Y
Walker Branch	440040	A	N	Y	Y	N	Y	Y
Giles Co	441140	A	Y	Y	Y	N	^	N
GSMP-Elkmont	441190	A	Y	Y	Y	N	Y	N
Hatchie NWR	441400	A	Y	Y	Y	Y	Y	N
Muleshoe NWR	450250	B	Y	Y	Y	Y	Y	N
Beeville	450350	B	Y	Y	Y	Y	Y	Y
K-Bar Big Bend NP	450425	A	N	Y	Y	Y	Y	N
Attwater	451040	E	Y	Y	Y	Y	Y	Y
Sonora	451650	E	Y	Y	Y	Y	Y	N
Longview	452180	A	Y	Y	Y	Y	Y	N
Guadalupe Mtns NP	452215	E	Y	Y	Y	Y	Y	N
Forest Seed	453800	A	Y	Y	Y	N	Y	N
Throckmorton	455180	E	Y	Y	Y	Y	Y	N
Victoria	455350	A	Y	Y	Y	Y	Y	N
LBJ Nat Grassland	455640	A	Y	Y	Y	Y	Y	N
Bryce Canyon	460110	A	Y	Y	Y	Y	Y	N
Logan	460120	A	N	N	Y	N	Y	N
Green River	460281	E	Y	Y	Y	N	Y	N
Bennington	470100	A	Y	Y	N	Y	Y	N
Underhill	470180	A	N	Y	Y	Y	Y	N
Charlottesville	480060	C	Y	Y	Y	Y	Y	N
Horton Stn	481300	A	^	^	^	Y	^	^
Big Meadows	482890	A	Y	Y	Y	Y	N	Y
Loves Mill	483300	A	Y	Y	Y	Y	Y	N

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* (A) AC only; (B) AC w/ Aerochem trickle charger/battery; (C) Battery only; (D) Battery w/ external AC powered charger; (E) Solar; (F) Other.

TABLE 5 (cont). AEROCHEM METRICS COLLECTOR SYSTEM CHECKS

Site Name	ID	Power Type *	Collector Level	Collector Stable	Sensor Clean	Bucket Tie-down Used	Correct Counter-Weight	Clutch Worn
Olympic NP	491410	B	Y	Y	Y	Y	Y	N
Sullivan Lake	491540	E	N	Y	Y	N	Y	N
Marblemount	491940	E	Y	Y	Y	Y	Y	N
La Grande	492180	E	Y	Y	Y	Y	Y	N
Palouse Farm	492420	A	Y	Y	Y	Y	Y	N
Babcock State Park	500460	E	Y	Y	Y	Y	Y	N
Parsons	501860	A	Y	Y	Y	Y	^	Y
Suring	512500	B	Y	Y	Y	Y	Y	N
Lake Dubay	512800	A	Y	Y	Y	Y	Y	N
Trout Lake	513640	A	Y	Y	Y	Y	^	N
Lake Geneva	513680	A	Y	Y	Y	Y	Y	N
Spooner	513700	B	Y	Y	Y	Y	Y	N
Snowy Range	520020	E	Y	Y	Y	Y	Y	N
Sinks Canyons	520260	A	Y	Y	Y	Y	Y	Y
South Pass	520261	E	Y	Y	Y	Y	N	N
Pinedale	520680	A	Y	Y	Y	Y	Y	Y
Gypsum Creek	520681	E	Y	Y	Y	Y	Y	Y
Newcastle	520820	A	Y	Y	Y	Y	Y	N
Tower YNP	520860	A	Y	Y	Y	N	^	N
American Samoa	530190	A	Y	Y	Y	Y	Y	N

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* (A) AC only; (B) AC w/ Aerochem trickle charger/battery; (C) Battery only; (D) Battery w/ external AC powered charger; (E) Solar; (F) Other.

Counterweight

The moving bucket lid should be properly counterweighted so the lid can be moved without excessive motor strain or clutch slippage. Improper counterweighting is usually found at sites which have added snow roofs. Only six site collectors were found with improper counterweights and half of those showed signs of excessive clutch wear.

Clutch Wear

The motor box clutch assembly should not show signs of excessive wear as evidenced by a shiny clutch surface. Thirty sites (15%) had evidence of excessive clutch wear. There are several causes of clutch slippage in addition to improper counterweighting discussed above. Regardless of the cause, this is one of the clearer indications that site data may be biased. The usual result of clutch slippage is that samples are not collected because the bucket lid fails to move off the wet bucket at the start of a precipitation event.

Bucket Tie Down

Both the wet and dry collection buckets should be secured to the collector with tie down straps to prevent their being blown out during strong winds. Thirty-one sites (16%) did not secure the buckets. The actual incidence of sample loss due to this variance is probably very rare, however.

Precipitation Collector Performance Checks

Table 6 lists the results of performance checks conducted on the Aerochem Metrics precipitation collectors.

Cover Seats Properly on Wet Bucket

The collector's bucket cover should fit tightly and evenly on the rim of the wet (and dry) bucket so that dust cannot enter during dry periods (and so that the lid liner is protected during wet periods). Only four collectors

TABLE 6. AEROCHEM METRICS COLLECTOR PERFORMANCE CHECKS

Site Name	ID	No Gaps; Bucket-lid Seal	Lid Tension (g)	Lid Drop (mm)	Sensor Performance *
Blackbelt	011000	Y	2300	11	C
Sand Mtn	011020	Y	2000	4	C
Denali	020390	Y	2000	16	C
Oliver Knoll	030360	Y	1700	15	C
Grand Canyon	030370	^	^	^	^
Organ Pipe Cactus	030620	Y	1400	12	C
Warren	040260	Y	2600	10	B
Caddo Valley	040380	Y	2800	13	C
Buffalo NR	041620	Y	2700	15	C
Fayetteville	042700	Y	2300	13	C
Tanbark Flat	054200	Y	2000	14	C
Hopland	054540	Y	2000	16	C
Palomar	056820	Y	1500	6	C
Sequoia	057550	Y	1500	10	C
Montague	057680	Y	^	14	C
Chuchupate	058501	Y	1700	10	C
Davis	058840	Y	1300	15	C
Yosemite	058850	Y	1700	9	A
Alamosa	060060	Y	3200	14	C
Las Animas	060180	Y	3600	13	C
Niwot Saddle	060220	N	1900	0	C
Mesa Verde	061530	Y	2800	7	C
Sand Spring	061560	Y	1800	8	C
Rocky Mtn Nat Park	061910	Y	2300	15	B
Loch Vale	061911	N	2400	1	C
Buffalo Pass	061920	Y	2200	15	C
Manitou	062120	Y	1800	11	C
Pawnee	062220	Y	2700	11	C
Bradford Ft	100360	Y	1700	^	C
CIFANT	100380	Y	2000	^	C
Everglades	101190	Y	^	^	A
Quincy	101400	Y	2600	^	C
Verna Well	104100	Y	2800	^	C
Bellville	112040	Y	2500	^	B
Ft Frederica	112380	Y	2900	8	C

* (A) Heats continuously; (B) Does not heat; (C) Operates properly.

TABLE 6 (cont). AEROCHEM METRICS COLLECTOR PERFORMANCE CHECKS

Site Name	ID	No Gaps; Bucket-lid Seal	Lid Tension (g)	Lid Drop (mm)	Sensor Performance *
Georgia Stn	114140	Y	2500	^	C
Tifton ARS	115000	Y	2400	^	C
Mauna Loa	120080	Y	^	^	C
Craters of the Moon	130343	Y	1500	11	C
Headquarters	130480	Y	2300	12	A
Reynold's Creek	131180	Y	2500	14	B
Smith's Ferry	131500	Y	2500	12	C
Bondville	141160	Y	1800	8	C
Shabbona	141800	Y	2000	11	C
Argonne	141980	Y	1700	13	C
Southern Il Univ	143580	Y	1700	10	C
Salem	144740	Y	2000	8	C
Dixon Springs	146340	Y	1600	15	B
Monmouth	147860	Y	1700	16	C
Huntington Res	152020	Y	1700	10	B
SW Purdue Ag Ctr	152260	Y	2500	9	B
Indiana Dunes	153421	Y	1700	15	C
Purdue U Ag Farm	154100	Y	2300	9	B
Big Springs	160880	Y	3200	11	C
McNay Research Stn	162320	Y	2800	12	C
Farlington	170740	Y	3200	10	C
Konza Prairie	173120	Y	2150	6	C
Lake Scott	173280	Y	2100	12	A
Perryville	180360	Y	2800	8	C
LC Woods	182260	Y	2100	4	C
Clark State	183560	Y	2000	15	C
Land Btwn the Lakes	183860	Y	^	15	C
Hill Farm	190620	Y	2600	12	C
Iberia	191260	Y	2500	6	C
SE Research Stn	193060	Y	1900	7	C
Acadia	200011	Y	1500	13	C
Caribou	200045	Y	2000	18	C
Presque Isle	200046	Y	2000	20	C
Bridgton	200275	Y	1500	10	C
Greenville	200935	Y	1500	16	C

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* (A) Heats continuously; (B) Does not heat; (C) Operates properly.

TABLE 6 (cont). AEROCHEM METRICS COLLECTOR PERFORMANCE CHECKS

Site Name	ID	No Gaps; Bucket-lid Seal	Lid Tension (g)	Lid Drop (mm)	Sensor Performance *
White Rock	210360	Y	2500	12	C
Wye	211320	N	2200	^	C
NACL	220155	Y	2300	12	C
Cadwell Creek	220815	Y	2500	9	C
East	221325	Y	2500	10	C
U of MI Biol Stn	230920	Y	2000	10	A
Raco	230980	Y	1500	14	C
Houghton	232241	Y	2400	10	C
Isle Royale NP	232571	Y	2000	10	C
Kellogg Biol Stn	232660	Y	1500	11	C
Pine River	235340	Y	2300	15	C
Marcell Stn	241660	Y	3200	13	C
Fernburg Stn	241840	Y	^	^	^
Camp Ripley	242360	Y	2400	12	C
SW Experimental Stn	242720	Y	2400	15	C
Clinton	251080	Y	2600	12	B
Meridian	251460	Y	2000	10	C
Coffeeville	253000	Y	2200	10	B
Ashland Wildlife	260380	Y	1700	15	C
University Forest	260560	Y	2700	11	C
Custer Battlefield	270060	Y	2000	12	C
St Mary Ranger Stn	270560	^	^	^	^
Glacier NP FWS	270570	Y	2000	14	C
Havre	270740	Y	2000	14	C
Clancy	270760	Y	2500	17	C
Give-Out-Morgan	271340	Y	3200	5	C
Mead	281520	Y	2100	11	C
North Platte	281580	Y	2500	8	C
Red Rock Canyon	290080	Y	2000	12	C
Saval Ranch	290140	Y	3000	12	C
Smith Valley	290360	Y	2000	12	C
Lehman Cave NM	290560	Y	1500	15	C
Hubbard Brook	300240	Y	2000	12	C
Washington Crossing	312980	Y	1750	16	C
Gila Cliff	320180	Y	2000	10	C

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* (A) Heats continuously; (B) Does not heat; (C) Operates properly.

TABLE 6 (cont). AEROCHEM METRICS COLLECTOR PERFORMANCE CHECKS

Site Name	ID	No Gaps; Bucket-lid Seal	Lid Tension (g)	Lid Drop (mm)	Sensor Performance *
Bandelier	320720	Y	1700	10	C
Mayhill	320840	Y	1500	10	C
Cuba NM	320980	Y	2300	5	C
Capulin Mountain	321280	Y	2500	^	C
Aurora	330860	Y	1500	12	B
Chautauqua	331000	Y	1500	10	C
Huntington	332020	Y	2500	19	C
Whiteface Mtn	332020	Y	1500	^	C
West Point	335141	Y	2000	7	C
Bennett Bridge	335240	Y	^	15	C
Jasper	336500	Y	2000	11	C
Biscuit Brook	336840	Y	2000	11	C
Lewiston	340320	Y	2700	^	C
Coweeta	342500	Y	2100	13	B
Piedmont Res Stn	343460	Y	1700	14	C
Clinton Crops	343560	Y	2000	16	C
Jordan Creek	343600	Y	2100	^	A
Finley Farm	344160	Y	4000	^	C
Clingman's Peak	344500	Y	2200	17	C
T.R. National Park	350700	Y	2600	10	C
Icelandic State Pk	350880	Y	2700	15	C
Woodworth	351180	Y	2300	7	B
Oxford	360900	Y	1900	15	C
Delaware	361760	Y	1700	11	C
Caldwell	364900	Y	2600	11	C
Wooster	367160	Y	2700	14	C
Salt Plain NWR	370060	Y	2300	16	C
Great Plains	371740	N	^	^	^
Clayton Lake	372580	Y	1600	10	C
Goodwell	372920	Y	1800	20	B
Alsea Guard	380200	Y	2200	9	C
Hyslop Farm	380202	Y	3600	10	C
Bull Run	380260	Y	2400	^	C
Silver Lake	380980	Y	2500	12	C
Andrews Forest	381020	Y	2100	12	C

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* (A) Heats continuously; (B) Does not heat; (C) Operates properly.

TABLE 6 (cont). AEROCHEM METRICS COLLECTOR PERFORMANCE CHECKS

Site Name	ID	No Gaps; Bucket-lid Seal	Lid Tension (g)	Lid Drop (mm)	Sensor Performance *
Vines Hill	381120	Y	2100	2	B
Starkey Exp Stn	381800	Y	2400	11	C
Penn State	391520	Y	1700	10	C
Kane Exp Forest	392940	Y	1500	15	C
Leading Ridge	394200	Y	1800	12	C
Milford	397220	Y	2000	9	C
El Verde	402020	Y	2700	13	C
Santee NWR	420680	Y	2500	^	C
Clemson	421880	Y	2000	14	B
Huron Well Field	430061	Y	2700	15	C
Cottonwood	430880	Y	1800	10	C
Walker Branch	440040	Y	2000	^	C
Giles Co	441140	Y	2000	10	C
GSMP-Elkmont	441190	Y	1300	13	B
Hatchie NWR	441400	Y	2700	9	A
Muleshoe NWR	450250	Y	2500	13	C
Beeville	450350	Y	2200	3	C
K-Bar Big Bend NP	450425	Y	1500	10	C
Attwater	451040	Y	3200	19	C
Sonora	451650	Y	1700	10	C
Longview	452180	Y	2800	16	C
Guadalupe Mtns NP	452215	Y	1500	15	C
Forest Seed	453800	Y	2500	13	C
Throckmorton	455180	Y	2000	13	C
Victoria	455350	Y	2300	16	C
LBJ Nat Grassland	455640	Y	2000	10	B
Bryce Canyon	460110	Y	1600	10	C
Logan	460120	Y	2500	11	C
Green River	460281	Y	2000	12	C
Bennington	470100	Y	2000	10	B
Underhill	470180	Y	2200	13	C
Charlottesville	480060	Y	2200	^	C
Horton Stn	481300	Y	^	^	^
Big Meadows	482890	Y	2800	^	C
Loves Mill	483300	Y	2400	15	C

* (A) Heats continuously; (B) Does not heat; (C) Operates properly.

TABLE 6 (cont). AEROCHEM METRICS COLLECTOR PERFORMANCE CHECKS

Site Name	ID	No Gaps; Bucket-lid Seal	Lid Tension (g)	Lid Drop (mm)	Sensor Performance *
Olympic NP	491410	Y	1600	13	A
Sullivan Lake	491540	Y	2800	11	C
Marblemount	491940	Y	2400	12	B
La Grande	492180	Y	2600	12	B
Palouse Farm	492420	Y	^	^	^
Babcock State Park	500460	Y	2500	16	C
Parsons	501860	Y	^	^	C
Suring	512500	Y	3000	16	C
Lake Dubay	512800	Y	2600	7	C
Trout Lake	513640	Y	2800	8	B
Lake Geneva	513680	Y	1900	6	C
Spooner	513700	Y	2300	6	C
Snowy Range	520020	Y	2600	9	C
Sinks Canyons	520260	Y	1700	6	C
South Pass	520261	Y	2500	15	C
Pinedale	520680	Y	^	10	C
Gypsum Creek	520681	Y	1500	11	B
Newcastle	520820	Y	2200	20	B
Tower YNP	520860	Y	1500	5	C
American Samoa	530190	Y	^	^	C

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* (A) Heats continuously; (B) Does not heat; (C) Operates properly.

(2%) were noted with bucket-lid seal problems based on visual inspections.

Lid Tension

The force that the bucket cover exerts against the rim of the collection bucket may be assessed by lifting the lid slightly above the bucket and reading the force (in grams) required to do so. A spring scale is used. Generally, tensions of 1500 g or greater are found. Three sites had lid tensions less than 1500 g. Whether or not these lower tensions are significant cannot be determined at this time.

Lid Drop Distance

Another measure of adequate lid/bucket seal tension is the lid drop distance--the distance the lid drops when the wet bucket is momentarily removed. The Central Analytical Laboratory of the NADP/NTN network has found that a distance of 3 mm or greater is required to give good, dust-free seals.

Not all collectors were checked in this manner because the test was not used initially in the program. Of 167 site collectors checked, only four (2%) had lid drops of 3 mm or less.

Ambient Sensor Grid Temperatures

Generally, the temperature of the precipitation collector sensor is at ambient level when there is no precipitation. If the ambient temperature is below 4°C, the sensor heater should come on, at a lower power level, to melt ice or snow that may fall. Sensors should not be heating at ambient temperatures above 4°C unless it is raining. If it is heating, light rainfall will strike the sensor and evaporate before the circuit can be made to open the lid or the lid will cycle between the wet and dry buckets throughout the event. Thirty-two collector sensors (16%) were found to malfunction.

Rain Gauge System Checks

Results of six system checks of the installation and operation of the Belfort gauge are given in Table 7. Also included is a column indicating whether the gauge was calibrated during the site visit.

Gauge Level

The rain gauge should be level so that precipitation collection efficiency is not biased by wind direction or by variation in effective exposure area. Fifteen rain gauges (8%) were out of level by small amounts.

Opening Round

The Belfort rain gauge principle of operation requires that the collection orifice be a circular orifice, eight inches in diameter. Changes in this requirement alter the cross-sectional area of the orifice and hence the gauge calibration. Only 2 gauge openings were out of round by more than 1/8 inch (based on two opposing measurements of the diameter).

Alter Shields

Alter shields may be used with rain gauges in the NADP/NTN network to abate strong winds near the gauge and improve collection efficiency. Thirty-four sites (17%) used them.

Chart Recorders

When checked at the time of the site visit, the chart recorded should indicate the correct time ± one hour. The rain gauge chart recorders were off by more than 1 hour at 12 sites (6%),

Damping Fluid Levels

The Belfort gauge damping fluid reservoir should be filled to within 0.25 inch of the top to reduce pen "noise" created by strong winds. Charts showing excessive pen noise are difficult to read accurately.

The damping fluid levels were low at 29 sites (15%).

TABLE 7. BELFORT RAIN GAUGE SYSTEM CHECKS

Site Name	ID	Gauge Level	Orifice Round	Alter Shield	Winterized	Time Correct +/- 1 hr	Dampening Fluid OK	Gauge Calibrated by RTI
Blackbelt	011000	Y	Y	N	N	Y	^	N
Sand Mtn	011020	Y	Y	N	Y	Y	^	N
Denali	020390	Y	Y	N	Y	N	Y	Y
Oliver Knoll	030360	Y	Y	Y	Y	Y	Y	Y
Grand Canyon	030370	Y	Y	N	Y	Y	Y	N
Organ Pipe Cactus	030620	Y	Y	N	N	Y	Y	Y
Warren	040260	Y	Y	N	Y	Y	Y	Y
Caddo Valley	040380	Y	Y	N	Y	Y	Y	N
Buffalo NR	041620	Y	Y	N	Y	Y	Y	Y
Fayetteville	042700	^	^	^	N	^	^	^
Tanbark Flat	054200	Y	Y	N	N	Y	Y	N
Hopland	054540	Y	Y	N	N	Y	Y	Y
Palomar	056820	Y	Y	N	Y	Y	N	Y
Sequoia	057550	Y	Y	Y	Y	Y	Y	N
Montague	057680	Y	Y	Y	Y	Y	Y	Y
Chuchupate	058501	Y	Y	N	Y	Y	Y	Y
Davis	058840	Y	Y	N	N	Y	N	N
Yosemite	058850	Y	Y	N	Y	Y	Y	N
Alamosa	060060	Y	Y	N	Y	N	Y	N
Las Animas	060180	Y	Y	N	Y	Y	Y	Y
Niwot Saddle	060220	Y	Y	Y	Y	Y	^	N
Mesa Verde	061530	Y	Y	N	Y	Y	N	Y
Sand Spring	061560	Y	Y	Y	Y	Y	N	N
Rocky Mtn Nat Park	061910	Y	Y	N	Y	Y	Y	N
Loch Vale	061911	N	Y	Y	Y	Y	^	^
Buffalo Pass	061920	Y	N	N	Y	Y	Y	N
Manitou	062120	N	Y	N	Y	Y	Y	N
Pawnee	062220	Y	Y	Y	Y	Y	Y	N
Bradford Ft	100360	Y	^	N	N	Y	^	N
CIFANT	100380	Y	^	N	^	Y	^	N
Everglades	101190	N	Y	^	N	Y	^	N
Quincy	101400	Y	Y	N	N	Y	^	N
Verna Well	104100	Y	Y	N	N	Y	^	Y
Bellville	112040	Y	Y	N	N	Y	^	N
Ft Frederica	112380	Y	Y	N	Y	Y	Y	N

TABLE 7 (cont). BELFORT RAIN GAUGE SYSTEM CHECKS

Site Name	ID	Gauge Level	Orifice Round	Alter Shield	Winterized	Time Correct +/- 1 hr	Dampening Fluid OK	Gauge Calibrated by RTI
Georgia Stn	114140	Y	Y	N	Y	Y	^	Y
Tifton ARS	115000	Y	Y	N	N	Y	^	N
Mauna Loa	120080	Y	Y	N	^	Y	Y	N
Craters of the Moon	130343	Y	Y	N	Y	Y	Y	Y
Headquarters	130480	Y	Y	N	Y	Y	N	N
Reynold's Creek	131180	Y	Y	Y	Y	Y	Y	N
Smith's Ferry	131500	Y	Y	Y	Y	Y	Y	N
Bondville	141160	Y	Y	N	Y	Y	Y	N
Shabbona	141800	N	Y	N	Y	N	Y	N
Argonne	141980	Y	Y	N	Y	Y	Y	Y
Southern Il Univ	143580	Y	Y	N	Y	Y	Y	Y
Salem	144740	Y	Y	^	Y	Y	Y	N
Dixon Springs	146340	Y	Y	N	Y	Y	Y	N
Monmouth	147860	Y	Y	N	Y	Y	N	Y
Huntington Res	152020	N	Y	Y	Y	Y	Y	Y
SW Purdue Ag Ctr	152260	N	Y	N	Y	Y	Y	Y
Indiana Dunes	153421	Y	Y	N	Y	N	Y	Y
Purdue U Ag Farm	154100	Y	Y	N	Y	Y	Y	N
Big Springs	160880	Y	Y	Y	Y	Y	Y	Y
McNay Research Stn	162320	Y	Y	Y	Y	Y	Y	Y
Farlington	170740	Y	Y	N	Y	Y	Y	Y
Konza Prairie	173120	Y	Y	N	Y	Y	Y	Y
Lake Scott	173280	Y	Y	N	Y	Y	Y	N
Perryville	180360	Y	Y	N	Y	^	Y	N
LC Woods	182260	Y	Y	N	Y	Y	^	N
Clark State	183560	Y	Y	N	Y	Y	Y	Y
Land Btwn the Lakes	183860	Y	Y	N	N	Y	^	N
Hill Farm	190620	Y	Y	N	N	Y	Y	Y
Iberia	191260	Y	Y	N	N	Y	Y	Y
SE Research Stn	193060	Y	Y	N	N	Y	Y	Y
Acadia	200011	Y	Y	N	Y	Y	Y	Y
Caribou	200045	Y	Y	Y	Y	Y	Y	N
Presque Isle	200046	Y	Y	N	Y	Y	Y	N
Bridgton	200275	Y	Y	N	Y	N	Y	Y
Greenville	200935	Y	Y	N	Y	Y	Y	Y

TABLE 7 (cont). BELFORT RAIN GAUGE SYSTEM CHECKS

Site Name	ID	Gauge Level	Orifice Round	Alter Shield	Winterized	Time Correct +/- 1 hr	Dampening Fluid OK	Gauge Calibrated by RTI
White Rock	210360	Y	Y	N	Y	Y	Y	N
Wye	211320	Y	Y	N	Y	Y	^	Y
NACL	220155	Y	Y	N	Y	Y	Y	N
Cadwell Creek	220815	Y	Y	Y	Y	Y	Y	Y
East	221325	Y	Y	N	Y	^	^	^
U of MI Biol Stn	230920	Y	Y	N	Y	Y	Y	Y
Raco	230980	Y	Y	N	Y	^	Y	Y
Houghton	232241	Y	Y	N	Y	Y	Y	Y
Isle Royale NP	232571	N	Y	N	^	Y	Y	Y
Kellogg Biol Stn	232660	Y	Y	N	Y	Y	Y	Y
Pine River	235340	Y	Y	Y	Y	Y	Y	N
Marcell Stn	241660	Y	Y	N	^	Y	Y	N
Fernburg Stn	241840	^	^	^	^	^	^	^
Camp Ripley	242360	Y	Y	N	Y	Y	Y	Y
SW Experimental Stn	242720	N	Y	N	Y	Y	Y	N
Clinton	251080	Y	Y	N	N	Y	^	N
Meridian	251460	Y	Y	N	N	Y	^	N
Coffeeville	253000	N	Y	N	N	Y	^	Y
Ashland Wildlife	260380	Y	Y	N	Y	N	Y	N
University Forest	260560	Y	Y	N	Y	Y	^	Y
Custer Battlefield	270060	Y	Y	N	Y	Y	Y	N
St Mary Ranger Stn	270560	^	^	^	^	^	^	^
Glacier NP FWS	270570	Y	Y	N	Y	Y	Y	Y
Havre	270740	Y	Y	Y	Y	Y	Y	N
Clancy	270760	Y	Y	Y	Y	Y	N	N
Give-Out-Morgan	271340	Y	Y	N	Y	Y	Y	Y
Mead	281520	Y	Y	N	Y	^	N	Y
North Platte	281580	Y	Y	Y	Y	Y	Y	Y
Red Rock Canyon	290080	Y	Y	N	Y	Y	Y	Y
Saval Ranch	290140	Y	Y	Y	^	Y	N	Y
Smith valley	290360	Y	Y	Y	Y	Y	Y	Y
Lehman Cave NM	290560	Y	Y	N	Y	Y	N	Y
Hubbard Brook	300240	Y	Y	Y	Y	Y	Y	N
Washington Crossing	312980	Y	Y	N	Y	Y	Y	N
Gila Cliff	320180	Y	Y	N	N	N	Y	Y

TABLE 7 (cont). BELFORT RAIN GAUGE SYSTEM CHECKS

Site Name	ID	Gauge Level	Orifice Round	Alter Shield	Winterized	Time Correct +/- 1 hr	Dampening Fluid OK	Gauge Calibrated by RTI
Bandelier	320720	Y	Y	N	N	Y	Y	Y
Mayhill	320840	Y	Y	N	Y	N	N	Y
Cuba NM	320980	Y	Y	N	Y	N	Y	N
Capulin Mountain	321280	N	Y	N	Y	Y	N	Y
Aurora	330860	Y	Y	N	N	Y	N	N
Chautauqua	331000	Y	Y	N	Y	Y	Y	Y
Huntington	332020	Y	Y	N	Y	Y	N	Y
Whiteface Mtn	332020	Y	Y	N	Y		Y	Y
West Point	335141	Y	Y	N	Y	Y	Y	N
Bennett Bridge	335240	Y	Y	N	Y	Y	Y	N
Jasper	336500	Y	Y	N	Y	Y	N	Y
Biscuit Brook	336840	Y	Y	N	Y	Y	Y	Y
Lewiston	340320	Y	Y	N	N	^	^	N
Coweeta	342500	Y	Y	N	N	^	^	N
Piedmont Res Stn	343460	Y	Y	N	Y	Y	N	Y
Clinton Crops	343560	Y	Y	N	Y	Y	Y	Y
Jordan Creek	343600	Y	Y	N	N	Y	^	N
Finley Farm	344160	Y	^	N	Y	Y	^	Y
Clingman's Peak	344500	N	Y	N	Y	Y	Y	N
T.R. National Park	350700	Y	Y	N	Y	Y	Y	N
Icelandic State Pk	350880	Y	Y	Y	Y	Y	Y	N
Woodworth	351180	Y	Y	Y	Y	Y	Y	N
Oxford	360900	Y	Y	N	Y	Y	Y	N
Delaware	361760	Y	Y	N	Y	Y	Y	Y
Caldwell	364900	Y	Y	N	^	Y	Y	Y
Wooster	367160	N	Y	N	^	Y	N	N
Salt Plain NWR	370060	Y	Y	N	Y	Y	N	N
Great Plains	371740	Y	Y	N	Y	Y	N	N
Clayton Lake	372580	Y	Y	N	Y	Y	Y	N
Goodwell	372920	Y	Y	N	Y	Y	Y	N
Alsea Guard	380200	Y	Y	N	Y	Y	N	N
Hyslop Farm	380202	Y	Y	N	Y	Y	N	N
Bull Run	380260	Y	Y	Y	Y	Y	N	Y
Silver Lake	380980	Y	Y	Y	Y	Y	N	Y
Andrews Forest	381020	Y	Y	Y	Y	Y	N	Y

TABLE 7 (cont). BELFORT RAIN GAUGE SYSTEM CHECKS

Site Name	ID	Gauge Level	Orifice Round	Alter Shield	Winterized	Time Correct +/- 1 hr	Dampening Fluid OK	Gauge Calibrated by RTI
Vines Hill	381120	Y	Y	N	Y	N	Y	N
Starkey Exp Stn	381800	Y	Y	Y	Y	Y	Y	N
Penn State	391520	Y	Y	N	Y	Y	Y	N
Kane Exp Forest	392940	Y	Y	N	Y	Y	Y	Y
Leading Ridge	394200	Y	Y	N	Y	Y	Y	N
Milford	397220	Y	Y	N	Y	^	Y	Y
El Verde	402020	Y	Y	N	N	N	Y	N
Santee NWR	420680	Y	Y	N	N	Y	^	Y
Clemson	421880	Y	Y	N	N	Y	Y	Y
Huron Well Field	430061	Y	Y	Y	Y	Y	Y	Y
Cottonwood	430880	N	Y	N	Y	Y	Y	N
Walker Branch	440040	Y	Y	N	Y	Y	^	Y
Giles Co	441140	Y	Y	N	Y	Y	^	N
GSMP-Elkmont	441190	Y	Y	N	Y	Y	^	Y
Hatchie NWR	441400	N	Y	N	Y	Y	Y	N
Muleshoe	450250	Y	Y	Y	Y	Y	Y	N
Beeville	450350	Y	Y	N	N	Y	^	Y
K-Bar Big Bend NP	450425	Y	Y	N	Y	Y	Y	Y
Attwater	451040	Y	Y	N	N	Y	^	Y
Sonora	451650	Y	Y	N	Y	Y	Y	N
Longview	452180	Y	Y	N	^	Y	Y	N
Guadalupe Mtns NP	452215	Y	Y	N	Y	Y	N	N
Forest Seed	453800	Y	Y	Y	Y	Y	^	N
Throckmorton	455180	Y	^	N	Y	Y	Y	Y
Victoria	455350	Y	Y	N	^	Y	^	N
LBJ Nat Grassland	455640	Y	Y	N	Y	Y	Y	N
Bryce Canyon	460110	Y	Y	N	Y	Y	Y	Y
Logan	460120	Y	Y	N	Y	Y	Y	Y
Green River	460281	Y	Y	N	Y	Y	Y	Y
Bennington	470100	Y	Y	N	Y	Y	Y	Y
Underhill	470180	Y	Y	N	Y	Y	N	N
Charlottesville	480060	Y	Y	N	Y	Y	^	N
Horton Stn	481300	^	^	N	Y	^	^	N
Big Meadows	482890	Y	^	N	Y	Y	^	Y
Loves Mill	483300	Y	Y	N	Y	Y	^	N

TABLE 7 (cont). BELFORT RAIN GAUGE SYSTEM CHECKS

Site Name	ID	Gauge Level	Orifice Round	Alter Shield	Winterized	Time Correct +/- 1 hr	Dampening Fluid OK	Gauge Calibrated by RTI
Olympic NP	491410	N	Y	N	N	Y	N	Y
Sullivan Lake	491540	Y	Y	N	N	Y	N	N
Marblemount	491940	Y	Y	N	N	^	Y	Y
La Grande	492180	Y	Y	N	Y	Y	Y	N
Palouse Farm	492420	Y	Y	Y	Y	N	Y	N
Babcock State Park	500460	Y	Y	N	Y	Y	N	N
Parsons	501860	Y	Y	N	^	^	^	N
Suring	512500	Y	Y	N	^	Y	Y	N
Lake Dubay	512800	Y	Y	N	Y	^	Y	N
Trout Lake	513640	Y	Y	N	^	Y	Y	Y
Lake Geneva	513680	Y	Y	N	Y	Y	Y	Y
Spooner	513700	Y	N	N	Y	Y	Y	N
Snowy Range	520020	Y	Y	Y	Y	Y	Y	N
Sinks Canyons	520260	^	Y	N	Y	Y	Y	N
South Pass	520261	Y	Y	Y	Y	Y	Y	N
Pinedale	520680	Y	Y	N	Y	Y	Y	Y
Gypsum Creek	520681	Y	Y	Y	Y	Y	Y	N
Newcastle	520820	Y	Y	N	Y	Y	Y	N
Tower YNP	520860	Y	Y	N	Y	Y	Y	Y
American Samoa	530190	Y	Y	N	N	Y	Y	N

Rain Gauge Performance Check

The rain gauge calibration was checked using Belfort gauge calibration weights. Results of the check are shown in Table 8. One hundred and one gauges were in calibration (within ± 0.1 inch) up to a least 10 inches of rain. Sixty-nine sites had calibration errors in the 0-6 in range but of these, only 19 sites were out of calibration below four inches. Because most rain amounts are measured in the 0-4 in range (except when winterized) and because the event mass is measured as the difference in chart reading before and after the event, few measurable errors in precipitation mass measurements are expected due to inaccurate rain gauge calibration. Eighty-eight rain gauges (45%) were calibrated by RTI personnel during the site visits.

Sample Collection Procedures

Sample collection procedures were discussed with site operators to ascertain whether certain specified procedures were adhered to. Key among these are five procedures listed below and shown with results in Table 9.

1) Is the sample bucket changed every seven days, on Tuesday? The sample bucket should be changed every Tuesday morning unless its raining, etc. If it is raining the sample bucket should be changed as soon as the event ends or the following morning at 9 a.m., whichever comes first.

2) Is the collection bucket held only on the outside? Special care should be taken to avoid contaminating the precipitation sample.

3) Is the sample visually checked for contamination (bird droppings, leaves, etc.) prior to transport to the field laboratory? Some contaminants might be seen at the site before they dissolve en route to the field laboratory.

4) Is the sample bucket enclosed in its plastic bag and shipping container prior to shipment to the field laboratory? This procedure is essential to prevent sample contamination or spillage.

5) Are the rain gauge and collector checked for proper operation during the weekly site visit?

TABLE 8. BELFORT RAIN GAUGE PERFORMANCE CHECKS

	Depth At Which Check Exceeds +/- 0.1 Inch Agreement											
Site Name	1	2	3	4	5	6	7	8	9	10	11	12
Blackbelt	-	-	-	-	-	x	x	x	x	x	x	^
Sand Mtn	-	-	-	-	-	-	-	-	-	-	-	-
Denali	x	x	x	x	x	^	^	x	x	x	x	x
Oliver Knoll	-	-	-	-	-	-	-	-	-	-	-	-
Grand Canyon	^	^	^	^	^	^	^	^	^	^	^	^
Organ Pipe Cactus	-	-	-	-	-	-	-	-	-	-	-	-
Warren	-	-	-	-	-	x	x	x	x	x	x	^
Caddo Valley	-	-	-	-	-	-	-	-	-	-	-	-
Buffalo NR	-	-	-	-	-	-	-	-	-	-	-	-
Fayetteville	^	^	^	^	^	^	^	^	^	^	^	^
Tanbark Flat	-	-	-	-	-	-	-	-	-	-	-	-
Hopland	-	-	-	x	x	x	-	-	-	-	-	-
Palomar	-	-	x	x	x	x	x	x	x	x	-	-
Sequoia	-	-	-	-	-	-	-	-	-	-	-	-
Montague	-	x	x	x	-	-	x	x	x	x	x	x
Chuchupate	-	-	-	-	-	-	x	x	x	x	x	x
Davis	-	x	x	x	-	-	x	x	x	x	x	x
Yosemite	-	-	-	-	-	-	-	-	-	-	-	-
Alamosa	-	-	-	-	-	x	x	x	x	x	x	^
Las Animas	-	-	-	-	-	x	x	^	^	^	^	^
Niwot Saddle	x	x	^	x	x	x	x	^	^	^	^	^
Mesa Verde	-	-	-	-	^	x	^	^	^	^	^	^
Sand Spring	-	-	-	-	-	-	-	-	-	x	x	x
Rocky Mtn Nat Park	-	-	-	-	-	-	-	-	-	-	-	-
Loch Vale	^	^	^	^	^	^	^	^	^	^	^	^
Buffalo Pass	-	-	-	-	-	x	x	x	x	x	x	^
Manitou	-	-	-	-	-	x	x	x	x	x	x	^
Pawnee	-	-	-	-	-	x	x	x	x	x	x	-
Bradford Ft	-	-	-	-	-	-	-	-	-	-	-	-
CIFANT	-	-	-	-	-	-	-	-	-	-	-	-
Everglades	x	x	x	x	x	x	x	x	^	^	^	^
Quincy	-	-	-	x	-	-	-	-	-	-	-	x
Verna Well	-	-	x	x	x	^	^	^	^	^	^	^
Bellville	-	-	-	-	-	-	-	-	-	-	-	-
Ft Frederica	-	-	-	-	-	-	-	-	-	-	-	-

Key: - = OK x = outside +/- 0.1 inch ^ = not checked or offscale

TABLE 8 (cont). BELFORT RAIN GAUGE PERFORMANCE CHECKS

	Depth At Which Check Exceeds +/- 0.1 Inch Agreement											
Site Name	1	2	3	4	5	6	7	8	9	10	11	12
Georgia Stn	-	-	-	-	-	-	x	x	x	x	x	x
Tifton ARS	-	-	-	-	-	-	-	-	-	-	-	-
Mauna Loa	-	-	-	-	-	-	-	^	^	^	^	^
Craters of the Moon	-	-	-	x	x	x	x	x	x	x	x	^
Headquarters	-	-	-	-	-	-	-	x	x	x	x	x
Reynold's Creek	-	-	-	x	-	-	^	^	^	^	^	^
Smith's Ferry	-	-	-	-	x	-	-	-	-	-	^	^
Bondville	-	-	-	-	-	-	-	x	x	x	x	-
Shabbona	-	-	-	-	-	-	-	-	-	-	-	-
Argonne	-	-	x	x	x	-	-	-	x	x	x	^
Southern Il Univ	-	-	-	-	-	x	x	x	x	x	x	^
Salem	-	-	-	-	-	-	^	^	^	^	^	^
Dixon Springs	-	-	-	-	-	-	-	-	-	-	-	-
Monmouth	-	-	-	-	-	-	-	-	-	-	-	-
Huntington Res	-	-	x	x	-	x	x	x	x	x	x	x
SW Purdue Ag Ctr	-	-	-	-	-	-	-	-	-	-	-	-
Indiana Dunes	-	-	-	x	x	x	-	-	-	-	-	-
Purdue Univ Ag Farm	-	-	-	-	-	-	-	-	-	-	-	-
Big Springs	-	-	-	-	-	-	-	-	-	-	-	-
McNay Research Stn	-	-	-	-	-	-	-	-	x	x	x	x
Farlington	-	-	-	-	x	-	-	-	-	-	-	-
Konza Prairie	-	-	-	-	-	x	-	-	-	-	-	-
Lake Scott	-	-	-	-	-	-	-	-	-	-	-	-
Perryville	-	-	-	-	-	-	x	x	x	x	x	x
LC Woods	-	-	-	-	-	-	-	-	-	-	-	-
Clark State	-	-	x	x	x	x	x	x	x	^	^	^
Land Btwn the Lakes	-	-	-	-	-	-	-	-	-	^	^	^
Hill Farm	-	-	-	-	-	-	-	-	-	-	x	x
Iberia	-	-	-	-	-	-	x	-	-	-	x	x
SE Research Stn	-	-	-	-	-	-	x	x	x	-	-	x
Acadia	-	-	-	-	x	x	x	x	x	x	x	x
Caribou	-	-	-	-	-	x	x	x	x	x	x	x
Presque Isle	-	-	-	-	-	x	x	x	x	x	x	^
Bridgton	-	-	-	-	-	-	-	-	-	-	-	x
Greenville	-	-	-	-	-	x	x	x	x	x	x	^

Key: - = OK   x = outside +/- 0.1 inch   ^ = not checked or offscale

TABLE 8 (cont). BELFORT RAIN GAUGE PERFORMANCE CHECKS

	Depth At Which Check Exceeds +/- 0.1 Inch Agreement											
Site Name	1	2	3	4	5	6	7	8	9	10	11	12
White Rock	-	-	-	-	-	-	-	-	-	-	-	-
Wye	-	-	-	-	-	-	-	-	-	-	-	-
NACL	-	-	-	-	-	-	-	-	-	-	-	-
Cadwell Creek	-	-	-	-	-	-	-	-	-	x	x	x
East	-	-	-	-	-	-	-	-	-	-	-	-
U of MI Biol Stn	-	-	-	-	-	-	x	x	x	x	x	x
Raco	-	-	-	-	-	x	x	x	x	x	x	-
Houghton	-	-	-	-	-	-	-	-	-	-	-	-
Isle Royale NP	-	-	-	-	-	-	-	-	-	-	-	-
Kellogg Biol Stn	-	-	-	-	-	-	x	x	x	x	x	x
Pine River	-	-	-	-	-	-	-	-	-	-	-	-
Marcell Stn	-	-	-	-	-	-	-	-	-	-	-	-
Fernburg Stn	^	^	^	^	^	^	^	^	^	^	^	^
Camp Ripley	-	-	-	-	-	-	-	-	-	-	-	-
SW Experimental Stn	-	-	-	-	-	-	-	-	-	-	-	-
Clinton	-	-	-	-	-	-	-	-	-	-	-	-
Meridian	-	-	-	-	-	^	^	^	^	^	^	^
Coffeeville	-	-	-	-	-	-	-	-	-	x	x	x
Ashland Wildlife	-	-	-	-	-	x	x	x	-	-	-	-
University Forest	-	-	-	-	-	-	x	x	x	x	x	x
Custer Battlefield	-	-	-	-	-	-	-	-	-	-	-	-
St Mary Ranger Stn	^	^	^	^	^	^	^	^	^	^	^	^
Glacier NP FWS	-	-	-	-	-	x	x	x	x	x	x	^
Havre	-	-	-	-	-	-	-	-	-	-	-	-
Clancy	-	-	-	-	-	-	-	-	-	-	-	-
Give-Out-Morgan	-	-	-	-	-	-	-	-	-	-	-	-
Mead	-	-	-	-	x	x	x	x	x	x	x	^
North Platte	-	-	-	-	-	x	-	x	-	-	-	-
Red Rock Canyon	-	-	-	-	-	-	x	x	x	x	x	^
Saval Ranch	-	-	-	x	x	x	x	x	x	x	x	^
Smith Valley	-	-	-	-	-	-	x	x	x	x	-	-
Lehman Cave NM	-	-	-	-	-	-	x	x	x	x	x	x
Hubbard Brook	-	-	-	-	-	-	-	-	-	-	-	-
Washington Crossing	-	-	-	-	-	-	-	-	-	-	-	-
Gila Cliff	-	-	-	-	-	x	x	x	x	x	x	x

Key: - = OK x = outside +/- 0.1 inch ^ = not checked or offscale

TABLE 8 (cont). BELFORT RAIN GAUGE PERFORMANCE CHECKS

	Depth At Which Check Exceeds +/- 0.1 Inch Agreement											
Site Name	1	2	3	4	5	6	7	8	9	10	11	12
Bandelier	-	-	-	x	x	x	-	-	-	-	-	^
Mayhill	-	-	-	-	-	-	-	-	-	x	x	^
Cuba NM	-	-	-	-	-	x	x	x	x	x	x	x
Capulin Mountain	-	-	-	-	-	-	x	^	^	^	^	^
Aurora	-	-	-	-	-	-	-	-	-	-	-	-
Chautauqua	-	-	-	-	x	x	x	x	x	^	^	^
Huntington	-	-	-	-	-	-	-	-	x	x	x	^
Whiteface Mtn	-	-	-	-	-	x	x	x	x	x	x	^
West Point	-	-	-	-	-	-	-	-	-	-	-	-
Bennett Bridge	-	-	-	-	-	-	-	-	-	-	-	-
Jasper	-	-	-	-	-	-	x	x	x	x	x	x
Biscuit Brook	-	-	-	-	-	-	-	-	-	-	-	x
Lewiston	^	^	^	^	^	^	^	^	^	^	^	^
Coweeta	-	-	-	-	-	-	x	x	x	x	x	x
Piedmont Res Stn	-	-	-	-	-	x	x	x	x	x	x	^
Clinton Crops	-	-	-	-	-	x	x	x	x	x	x	^
Jordan Creek	-	-	-	-	-	-	-	-	-	-	^	^
Finley Farm	-	-	-	-	-	x	-	^	^	^	^	^
Clingman's Peak	-	-	-	-	-	-	-	-	-	-	-	-
T.R. National Park	-	-	-	-	-	-	-	-	-	-	x	-
Icelandic State Pk	-	-	-	-	-	-	-	-	-	-	-	-
Woodworth	-	-	-	-	-	-	-	-	-	-	-	-
Oxford	-	-	-	-	-	-	-	-	-	-	-	-
Delaware	-	-	-	-	-	x	x	x	x	x	^	^
Caldwell	-	-	-	-	-	-	-	-	-	-	x	-
Wooster	-	-	-	-	-	-	-	-	-	-	-	-
Salt Plain NWR	-	-	-	-	-	-	-	-	-	-	^	^
Great Plains	-	-	-	-	-	-	-	-	-	-	-	-
Clayton Lake	-	-	-	-	-	-	-	-	-	-	-	-
Goodwell	-	-	-	-	-	-	-	-	-	-	-	^
Alsea Guard	-	-	-	-	-	-	-	-	-	-	-	-
Hyslop Farm	-	-	-	-	-	-	-	-	-	-	-	-
Bull Run	-	-	-	-	-	x	x	x	x	x	x	^
Silver Lake	-	-	-	-	x	x	x	x	x	x	^	^
Andrews Forest	-	-	-	-	-	-	x	x	-	-	-	-

Key: - = OK x = outside +/- 0.1 inch ^ = not checked or offscale

TABLE 8 (cont). BELFORT RAIN GAUGE PERFORMANCE CHECKS

	Depth At Which Check Exceeds +/- 0.1 Inch Agreement											
Site Name	1	2	3	4	5	6	7	8	9	10	11	12
Vines Hill	-	-	-	-	-	-	-	-	-	-	-	-
Starkey Exp Stn	-	-	-	-	-	-	-	x	x	x	-	-
Penn State	-	-	-	-	-	-	-	-	-	-	-	-
Kane Exp Forest	-	-	-	-	-	x	x	x	x	x	^	^
Leading Ridge	-	-	-	-	-	-	-	-	-	-	-	-
Milford	-	-	-	-	x	-	x	x	x	x	x	^
El Verde	-	-	-	-	-	-	-	-	-	-	-	-
Santee NWR	-	-	x	x	x	x	x	x	x	^	^	^
Clemson	-	-	-	-	-	x	x	x	x	x	x	^
Huron Well Field	-	-	-	-	-	-	-	-	-	-	-	x
Cottonwood	-	-	-	-	-	-	-	-	-	-	-	-
Walker Branch	^	^	^	^	^	^	^	^	^	^	^	^
Giles Co	-	-	-	-	-	-	-	^	^	^	^	^
GSMP-Elkmont	-	-	-	-	-	-	-	-	-	-	-	-
Hatchie NWR	-	-	-	-	-	-	-	-	-	-	-	-
Muleshoe NWR	-	-	-	-	-	-	-	-	-	-	-	x
Beeville	-	-	-	-	-	-	-	-	x	x	x	x
K-Bar Big Bend	-	x	x	x	x	-	-	x	x	x	x	x
Attwater	-	-	-	-	-	^	^	^	^	^	^	^
Sonora	-	-	-	-	-	-	-	-	-	-	-	-
Longview	-	-	-	-	-	-	-	-	-	-	-	-
Guadalupe Mtns NP	-	-	-	-	-	-	-	-	-	-	-	-
Forest Seed	-	-	-	-	-	-	-	-	-	-	-	-
Throckmorton	-	-	-	-	-	-	-	-	-	-	-	x
Victoria	-	-	-	-	-	-	-	-	-	-	-	-
LBJ Nat Grassland	-	-	-	-	-	-	-	-	-	-	-	-
Bryce Canyon	-	-	-	-	-	-	-	-	-	-	-	-
Logan	-	-	-	-	-	x	x	x	x	x	x	^
Green River	-	-	-	-	-	x	x	x	x	x	x	^
Bennington	-	-	-	-	-	-	x	-	-	-	-	x
Underhill	-	-	-	-	-	-	-	-	-	-	-	-
Charlottesville	-	-	-	-	-	-	-	-	-	-	-	-
Horton Stn	^	^	^	^	^	^	^	^	^	^	^	^
Big Meadows	-	-	-	-	-	-	x	x	^	^	^	^
Loves Mill	-	-	-	-	-	-	-	-	-	-	-	x

Key: - = OK x = outside +/- 0.1 inch ^ = not checked or offscale

TABLE 8 (cont). BELFORT RAIN GAUGE PERFORMANCE CHECKS

	Depth At Which Check Exceeds +/- 0.1 Inch Agreement											
Site Name	1	2	3	4	5	6	7	8	9	10	11	12
Olympic NP	-	-	-	-	-	-	-	-	-	x	-	x
Sullivan Lake	-	-	-	-	-	-	x	x	x	x	x	x
Marblemount	-	-	-	-	-	-	x	x	x	x	x	x
La Grande	-	-	-	-	-	-	-	-	-	-	-	-
Palouse Farm	-	-	-	-	-	-	-	-	-	-	-	-
Babcock State Park	-	-	-	-	-	-	-	-	-	-	-	-
Parsons	-	-	-	-	-	-	-	-	-	-	-	-
Suring	-	-	-	-	-	-	-	-	-	-	-	-
Lake Dubay	-	-	-	-	-	-	-	-	-	-	-	^
Trout Lake	-	-	-	-	-	-	-	-	-	-	-	-
Lake Geneva	-	-	-	-	-	-	x	^	^	^	^	^
Spooner	-	-	-	-	-	-	-	-	-	-	-	-
Snowy Range	-	-	-	-	-	-	-	-	-	x	^	^
Sinks Canyon	-	-	-	-	-	-	-	-	-	-	-	-
South Pass	-	-	-	-	-	-	-	-	-	-	-	-
Pinedale	-	-	-	-	-	x	x	x	x	x	x	x
Gypsum Creek	-	-	-	-	-	-	-	-	-	-	-	-
Newcastle	-	-	-	-	-	-	-	-	-	-	-	-
Tower YNP	-	-	-	-	-	-	x	x	x	-	-	-
American Samoa	-	-	-	-	-	-	-	^	^	^	^	^

Key: - = OK   x = outside +/- 0.1 inch   ^ = not checked or offscale

TABLE 9. SAMPLE COLLECTION PROCEDURES

Site Name	ID	Bucket Held Only On Outside	Bucket Change, 7 Days	Weekly Equipment Check	Contam. Check At Site	Bucket Bagged/Boxed to Lab
Blackbelt	011000	Y	Y	Y	Y	Y
Sand Mtn	011020	Y	Y	Y	Y	Y
Denali	020390	Y	Y	Y	Y	Y
Oliver Knoll	030360	Y	Y	Y	Y	Y
Grand Canyon	030370	Y	Y	Y	Y	Y
Organ Pipe Cactus	030620	Y	Y	Y	Y	Y
Warren	040260	Y	Y	N	Y	N
Caddo Valley	040380	Y	Y	Y	Y	Y
Buffalo NR	041620	Y	Y	Y	Y	Y
Fayetteville	042700	Y	Y	Y	Y	Y
Tanbark Flat	054200	Y	Y	Y	Y	Y
Hopland	054540	Y	Y	Y	Y	N
Palomar	056820	Y	Y	Y	Y	Y
Sequoia	057550	Y	Y	Y	Y	Y
Montague	057680	Y	Y	Y	Y	Y
Chuchupate	058501	Y	Y	Y	Y	Y
Davis	058840	Y	Y	Y	Y	Y
Yosemite	058850	Y	Y	Y	Y	Y
Alamosa	060060	Y	Y	Y	Y	Y
Las Animas	060180	Y	Y	Y	N	Y
Niwot Saddle	060220	Y	Y	Y	Y	Y
Mesa Verde	061530	Y	Y	Y	N	Y
Sand Spring	061560	Y	Y	Y	Y	Y
Rocky Mtn Nat Park	061910	Y	Y	Y	Y	Y
Loch Vale	061911	Y	N	Y	Y	N
Buffalo Pass	061920	Y	Y	Y	Y	Y
Manitou	062120	Y	Y	Y	Y	N
Pawnee	062220	Y	Y	Y	N	Y
Bradfort Ft	100360	Y	Y	Y	Y	Y
CIFANT	100380	Y	Y	Y	Y	Y
Everglades	101190	Y	Y	Y	^	Y
Quincy	101400	Y	Y	Y	Y	Y
Verna Well	104100	Y	Y	Y	Y	Y
Bellville	112040	Y	Y	Y	Y	Y
Ft Frederica	112380	Y	Y	N	Y	Y

TABLE 9 (cont). SAMPLE COLLECTION PROCEDURES

Site Name	ID	Bucket Held Only On Outside	Bucket Change, 7 Days	Weekly Equipment Check	Contam. Check At Site	Bucket Bagged/Boxed to Lab
Georgia Stn	114140	Y	Y	N	Y	Y
Tifton ARS	115000	Y	Y	N	Y	N
Mauna Loa	120080	Y	Y	Y	Y	Y
Craters of the Moon	130343	Y	Y	Y	Y	Y
Headquarters	130480	Y	Y	N	Y	Y
Reynold's Creek	131180	Y	Y	Y	Y	Y
Smith's Ferry	131500	Y	Y	Y	Y	Y
Bondville	141160	Y	Y	Y	Y	Y
Shabbona	141800	Y	Y	Y	Y	Y
Argonne	141980	Y	Y	Y	Y	Y
Southern Il Univ	143580	Y	Y	Y	Y	Y
Salem	144740	Y	Y	Y	Y	Y
Dixon Springs	146340	Y	Y	Y	Y	Y
Monmouth	147860	Y	Y	Y	Y	Y
Huntington Res	152020	Y	Y	Y	Y	Y
SW Purdue Ag Ctr	152260	Y	Y	Y	Y	Y
Indiana Dunes	153421	Y	Y	Y	Y	Y
Purdue Univ Ag Farm	154100	Y	Y	Y	Y	Y
Big Springs	160880	Y	Y	Y	Y	Y
McNay Research Stn	162320	Y	Y	Y	Y	Y
Farlington	170740	Y	Y	N	^	^
Konza Prairie	173120	Y	Y	Y	Y	Y
Lake Scott	173280	Y	Y	Y	Y	Y
Perryville	180360	Y	Y	Y	Y	Y
LC Woods	182260	Y	Y	Y	Y	Y
Clark State	183560	Y	Y	Y	Y	Y
Land Btwn the Lakes	183860	Y	Y	Y	Y	Y
Hill Farm	190620	Y	Y	Y	Y	Y
Iberia	191260	Y	Y	Y	Y	Y
SE Research Stn	193060	Y	Y	Y	Y	Y
Acadia	200011	Y	Y	Y	Y	N
Caribou	200045	Y	Y	N	Y	N
Presque Isle	200046	Y	Y	Y	Y	Y
Bridgton	200275	Y	Y	Y	Y	N
Greenville	200935	Y	Y	Y	Y	Y

TABLE 9 (cont). SAMPLE COLLECTION PROCEDURES

Site Name	ID	Bucket Held Only On Outside	Bucket Change, 7 Days	Weekly Equipment Check	Contam. Check At Site	Bucket Bagged/Boxed to Lab
White Rock	210360	Y	Y	Y	Y	Y
Wye	211320	Y	Y	Y	Y	Y
NACL	220155	Y	Y	Y	Y	Y
Cadwell Creek	220815	Y	Y	Y	Y	N
East	221325	N	Y	Y	Y	Y
U of MI Biol Stn	230920	Y	Y	Y	N	N
Raco	230980	Y	Y	Y	Y	N
Houghton	232241	Y	Y	Y	Y	Y
Isle Royale NP	232571	Y	Y	Y	Y	Y
Kellogg Biol Stn	232660	Y	Y	Y	Y	Y
Pine River	235340	Y	Y	Y	Y	N
Marcell Stn	241660	Y	Y	Y	Y	Y
Fernburg Stn	241840	Y	Y	Y	Y	Y
Camp Ripley	242360	Y	Y	Y	Y	Y
SW Experimental Stn	242720	Y	Y	Y	Y	Y
Clinton	251080	Y	Y	Y	Y	N
Meridian	251460	Y	Y	N	Y	N
Coffeeville	253000	Y	Y	N	Y	Y
Ashland Wildlife	260380	Y	Y	Y	Y	Y
University Forest	260560	Y	Y	Y	Y	Y
Custer Battlefield	270060	Y	Y	N	Y	Y
St Mary Ranger Stn	270560	^	^	^	^	^
Glacier NP	270570	Y	Y	Y	Y	Y
Havre	270740	Y	Y	Y	Y	Y
Clancy	270760	Y	Y	Y	Y	Y
Give-Out-Morgan	271340	Y	Y	Y	Y	Y
Mead	281520	Y	Y	Y	Y	N
North Platte	281580	Y	Y	Y	Y	Y
Red Rock Canyon	290080	Y	Y	Y	Y	Y
Saval Ranch	290140	Y	Y	Y	Y	Y
Smith Valley	290360	Y	Y	Y	Y	Y
Lehman Cave NM	290560	Y	Y	Y	Y	N
Hubbard Brook	300240	Y	Y	Y	Y	N
Washington Crossing	312980	Y	Y	Y	Y	Y
Gila Cliff	320180	Y	Y	Y	Y	Y

TABLE 9 (cont). SAMPLE COLLECTION PROCEDURES

Site Name	ID	Bucket Held Only On Outside	Bucket Change, 7 Days	Weekly Equipment Check	Contam. Check At Site	Bucket Bagged/Boxed to Lab
Bandelier	320720	Y	Y	Y	Y	Y
Mayhill	320840	Y	Y	Y	Y	Y
Cuba NM	320980	^	^	^	^	^
Capulin Mountain	321280	Y	Y	Y	Y	Y
Aurora	330860	Y	Y	Y	Y	Y
Chautauqua	331000	Y	Y	Y	Y	Y
Huntington	332020	Y	Y	Y	Y	Y
Whiteface Mtn	332020	Y	Y	N	Y	Y
West Point	335141	Y	Y	Y	Y	Y
Bennett Bridge	335240	Y	Y	Y	Y	Y
Jasper	336500	Y	Y	Y	Y	Y
Biscuit Brook	336840	Y	Y	Y	Y	Y
Lewiston	340320	Y	Y	N	Y	N
Coweeta	342500	Y	Y	Y	Y	N
Piedmont Res Stn	343460	N	Y	Y	N	Y
Clinton Crops	343560	Y	Y	Y	Y	Y
Jordan Creek	343600	Y	Y	N	Y	Y
Finley Farm	344160	Y	Y	N	Y	N
Clingman's Peak	344500	Y	Y	Y	Y	Y
T.R. National Park	350700	Y	Y	Y	Y	Y
Icelandic State Pk	350880	Y	Y	Y	Y	Y
Woodworth	351180	Y	Y	Y	Y	Y
Oxford	360900	Y	Y	Y	Y	Y
Delaware	361760	Y	Y	Y	Y	N
Caldwell	364900	Y	Y	Y	Y	Y
Wooster	367160	Y	Y	Y	Y	Y
Salt Plain NWR	370060	Y	Y	Y	Y	Y
Great Plains	371740	^	^	^	^	^
Clayton Lake	372580	Y	Y	Y	Y	Y
Goodwell	372920	Y	Y	Y	Y	Y
Alsea Guard	380200	Y	Y	Y	Y	Y
Hyslop Farm	380202	Y	Y	Y	Y	Y
Bull Run	380260	Y	Y	N	Y	Y
Silver Lake	380980	Y	Y	Y	Y	Y
Andrews Forest	381020	Y	Y	Y	Y	Y

TABLE 9 (cont). SAMPLE COLLECTION PROCEDURES

Site Name	ID	Bucket Held Only On Outside	Bucket Change, 7 Days	Weekly Equipment Check	Contam. Check At Site	Bucket Bagged/Boxed to Lab
Vines Hill	381120	Y	F	N	Y	Y
Starkey Exp Stn	381800	Y	Y	Y	Y	Y
Penn State	391520	Y	Y	Y	Y	Y
Kane Exp Forest	392940	Y	Y	Y	Y	Y
Leading Ridge	394200	Y	Y	Y	Y	Y
Milford	397220	Y	Y	Y	Y	Y
El Verde	402020	Y	Y	Y	Y	N
Santee NWR	420680	Y	Y	N	Y	Y
Clemson	421880	Y	Y	Y	Y	Y
Huron Well Field	430061	Y	Y	Y	Y	Y
Cottonwood	430880	Y	Y	Y	Y	Y
Walker Branch	440040	Y	Y	N	Y	Y
Giles Co	441140	Y	Y	Y	Y	Y
GSMP-Elkmont	441190	Y	Y	Y	Y	Y
Hatchie NWR	441400	Y	Y	N	Y	Y
Muleshoe	450250	Y	Y	Y	Y	Y
Beeville	450350	Y	Y	Y	Y	Y
K-Bar Big Bend NP	450425	Y	Y	Y	Y	Y
Attwater	451040	Y	Y	Y	Y	Y
Sonora	451650	Y	Y	Y	Y	Y
Longview	452180	Y	Y	^	Y	Y
Guadalupe Mtns NP	452215	Y	Y	Y	Y	Y
Forest Seed	453800	Y	Y	Y	Y	Y
Throckmorton	455180	Y	Y	Y	Y	Y
Victoria	455350	Y	Y	Y	Y	Y
LBJ Nat Grassland	455640	Y	Y	Y	Y	Y
Bryce Canyon	460110	Y	Y	Y	Y	Y
Logan	460120	Y	Y	Y	Y	Y
Green River	460281	Y	Y	Y	Y	Y
Bennington	470100	Y	Y	Y	Y	Y
Underhill	470180	Y	Y	Y	Y	Y
Charlottesville	480060	Y	Y	Y	Y	Y
Horton Stn	481300	Y	^	^	Y	Y
Big Meadows	482890	Y	Y	Y	Y	Y
Loves Mill	483300	Y	Y	Y	Y	Y

TABLE 9 (cont). SAMPLE COLLECTION PROCEDURES

Site Name	ID	Bucket Held Only On Outside	Bucket Change, 7 Days	Weekly Equipment Check	Contam. Check At Site	Bucket Bagged/Boxed to Lab
Olympic NP	491410	Y	Y	Y	Y	Y
Sullivan Lake	491540	Y	Y	Y	Y	Y
Marblemount	491940	Y	Y	Y	Y	Y
La Grande	492180	Y	Y	Y	Y	Y
Palouse Farm	492420	N	Y	Y	Y	N
Babcock State Park	500460	Y	Y	N	Y	Y
Parsons	501860	Y	Y	Y	Y	N
Suring	512500	Y	Y	Y	Y	Y
Lake Dubay	512800	Y	Y	Y	Y	Y
Trout Lake	513640	Y	Y	Y	Y	Y
Lake Geneva	513680	Y	Y	Y	Y	Y
Spooner	513700	Y	Y	Y	Y	N
Snowy Range	520020	Y	Y	Y	Y	Y
Sinks Canyons	520260	Y	Y	Y	Y	Y
South Pass	520261	Y	Y	Y	Y	Y
Pinedale	520680	Y	Y	Y	Y	N
Gypsum Creek	520681	Y	Y	Y	Y	Y
Newcastle	520820	Y	Y	Y	Y	Y
Tower YNP	520860	Y	Y	Y	Y	Y
American Samoa	530190	Y	Y	Y	Y	Y

Most operators were using proper collection procedures and no instances of contamination were noted. The most frequently neglected procedure was the check for contamination at the site. Another check that is not done with regularity is to ascertain if the sensor heater is working by touching a finger to it five minutes after activation. The reasons for making these checks were explained to those operators who were not aware of them.

FIELD LABORATORY SURVEY

Systems Check of Field Laboratory

Laboratories that support the field collection sites were generally clean with adequate space and temperature control. Required records were kept and report forms were filled out correctly in all but a few cases. Rain gauge charts were usually not annotated fully with site name, date, time on, time off, etc. Field samples were shipped to CAL, generally within three days. For those few sites taking longer than three days before mailing samples to CAL ideas to speed up the process were suggested. Refer to Table 10 for field laboratory systems check results.

pH and Conductivity Measurement Techniques

In order to make accurate and precise pH and conductivity measurements the analyst must be familiar with the measurement equipment, follow appropriate calibration procedures, and use measurement techniques consistent with good laboratory practices. Field personnel were observed while making pH and conductivity measurements and key elements of their technique were noted.

Tables 11 and 12 present the results of checks considered key to good pH and conductivity measurements, respectively. In general, specified procedures were adhered to and laboratory technique was good. Procedural variances were only noted with site operators who had not, as yet, attended the CAL training course. Only 15 site operators (8%) had one or more variances with pH measurements, but fifty-seven operators (29%) had at least one procedural variance when measuring conductivity. The most frequent mistake (18%) was the failure to rinse the conductivity cell with sample and then measure a second aliquot.

TABLE 10. SYSTEM CHECKS OF FIELD LABORATORY

Site Name	ID	Space Adequate	Lab Clean	Temp. Control	Proper Weighing Technique	Report Forms Complete	Rain Charts Fully Annotated	Days Elapsed Sample Removal To Shipment
Blackbelt	011000	Y	Y	Y	Y	Y	N	1-2
Sand Mtn	011020	Y	Y	Y	Y	Y	Y	1
Denali	020390	Y	Y	Y	Y	Y	N	1-2
Oliver Knoll	030360	Y	Y	Y	Y	Y	Y	1
Grand Canyon	030370	Y	Y	Y	Y	Y	N	1
Organ Pipe Cactus	030620	Y	N	Y	Y	Y	Y	^
Warren	040260	Y	Y	Y	Y	Y	N	1-2
Caddo Valley	040380	Y	Y	Y	Y	Y	N	1
Buffalo NR	041620	Y	Y	Y	Y	Y	N	< 1
Fayetteville	042700	Y	Y	Y	Y	Y	^	2
Tanbark Flat	054200	Y	Y	Y	Y	Y	Y	2
Hopland	054540	Y	Y	Y	Y	Y	N	5
Palomar	056820	Y	Y	Y	Y	Y	Y	1
Sequoia	057550	Y	Y	Y	Y	Y	N	1
Montague	057680	Y	Y	Y	Y	Y	Y	< 1
Chuchupate	058501	Y	Y	Y	Y	Y	Y	1
Davis	058840	Y	Y	Y	Y	Y	N	1
Yosemite	058850	Y	N	N	Y	Y	N	1
Alamosa	060060	Y	Y	Y	Y	Y	N	1
Las Animas	060180	Y	Y	N	Y	Y	Y	^
Niwot Saddle	060220	Y	Y	N	Y	Y	^	1
Mesa Verde	061530	Y	Y	N	Y	Y	Y	< 1
Sand Spring	061560	Y	Y	Y	Y	Y	Y	1
Rocky Mtn Nat Park	061910	Y	Y	Y	Y	Y	Y	< 1
Loch Vale	061911	Y	Y	Y	N	^	Y	1
Buffalo Pass	061920	Y	Y	N	Y	Y	N	1
Manitou	062120	Y	Y	Y	Y	Y	N	3
Pawnee	062220	Y	Y	Y	Y	N	N	^
Bradford Ft	100360	Y	Y	Y	Y	^	^	4
CIFANT	100380	Y	Y	Y	Y	Y	Y	1
Everglades	101190	Y	Y	Y	^	Y	Y	< 3
Quincy	101400	Y	Y	Y	Y	Y	Y	^
Verna Well	104100	Y	Y	Y	^	Y	N	1
Bellville	112040	Y	Y	Y	Y	Y	N	< 1
Ft Frederica	112380	Y	Y	Y	Y	N	Y	1

TABLE 10. SYSTEM CHECKS OF FIELD LABORATORY

Site Name	ID	Space Adequate	Lab Clean	Temp. Control	Proper Weighing Technique	Report Forms Complete	Rain Charts Fully Annotated	Days Elapsed Sample Removal To Shipment
Georgia Stn	114140	Y	Y	Y	Y	Y	N	1-2
Tifton ARS	115000	Y	Y	Y	Y	Y	Y	1-2
Mauna Loa	120080	Y	Y	Y	Y	Y	Y	1-2
Craters of the Moon	130343	Y	Y	N	Y	Y	N	1
Headquarters	130480	Y	Y	Y	Y	Y	N	3
Reynold's Creek	131180	Y	Y	Y	Y	Y	N	^
Smith's Ferry	131500	Y	Y	Y	Y	Y	N	< 1
Bondville	141160	Y	Y	Y	Y	N	Y	1
Shabbona	141800	Y	Y	N	Y	Y	^	7
Argonne	141980	Y	Y	Y	Y	Y	Y	< 1
Southern Il Univ	143580	Y	Y	Y	Y	Y	Y	1
Salem	144740	Y	Y	Y	Y	Y	Y	2
Dixon Springs	146340	Y	Y	Y	Y	Y	Y	2
Monmouth	147860	Y	Y	Y	Y	Y	Y	2
Huntington Res	152020	Y	Y	N	Y	Y	N	1
SW Purdue Ag Ctr	152260	Y	Y	Y	Y	Y	N	1
Indiana Dunes	153421	Y	Y	Y	Y	Y	N	< 1
Purdue U Ag Farm	154100	Y	N	Y	Y	Y	N	1
Big Springs	160880	Y	Y	Y	Y	Y	Y	< 1
McNay Research Stn	162320	Y	Y	Y	Y	Y	Y	< 1
Farlington	170740	Y	Y	Y	Y	Y	N	^
Konza Prairie	173120	Y	Y	Y	Y	Y	N	2
Lake Scott	173280	Y	Y	Y	Y	Y	N	1
Perryville	180360	Y	Y	Y	Y	Y	N	2
LC Woods	182260	Y	Y	Y	Y	Y	N	1
Clark State	183560	Y	Y	Y	Y	Y	Y	1
Land Btwn the Lakes	183860	Y	Y	Y	Y	Y	Y	3
Hill Farm	190620	Y	Y	Y	N	Y	N	^
Iberia	191260	Y	Y	Y	N	Y	Y	1-2
SE Research Stn	193060	Y	Y	Y	N	Y	N	1-2
Acadia	200011	Y	Y	Y	Y	Y	N	1
Caribou	200045	Y	Y	Y	Y	Y	Y	1
Presque Isle	200046	Y	Y	Y	Y	Y	Y	1
Bridgton	200275	Y	Y	N	Y	Y	N	1-2
Greenville	200935	Y	Y	Y	Y	Y	Y	< 1

TABLE 10. SYSTEM CHECKS OF FIELD LABORATORY

Site Name	ID	Space Adequate	Lab Clean	Temp. Control	Proper Weighing Technique	Report Forms Complete	Rain Charts Fully Annotated	Days Elapsed Sample Removal To Shipment
White Rock	210360	Y	Y	Y	Y	Y	Y	^
Wye	211320	Y	Y	Y	Y	Y	Y	2
NACL	220155	Y	Y	Y	Y	Y	N	1
Cadwell Creek	220815	Y	Y	N	Y	Y	N	1-2
East	221325	Y	Y	Y	Y	Y	N	^
U of MI Biol Stn	230920	Y	Y	N	Y	Y	Y	1
Raco	230980	Y	Y	^	Y	Y	N	1
Houghton	232241	Y	Y	Y	Y	Y	Y	< 1
Isle Royale NP	232571	Y	Y	Y	N	Y	Y	< 1
Kellogg Biol Stn	232660	Y	Y	Y	^	Y	N	1
Pine River	235340	Y	Y	Y	Y	Y	Y	< 1
Marcell Stn	241660	Y	Y	Y	Y	Y	Y	1
Fernburg Stn	241840	Y	Y	Y	Y	Y	N	1
Camp Ripley	242360	Y	Y	Y	Y	Y	Y	1
SW Experimental Stn	242720	Y	Y	Y	Y	Y	Y	1
Clinton	251080	Y	Y	N	Y	Y	N	1
Meridian	251460	Y	Y	Y	Y	Y	^	1
Coffeeville	253000	Y	Y	Y	Y	Y	N	1
Ashland Wildlife	260380	Y	Y	Y	Y	Y	Y	1
University Forest	260560	Y	Y	Y	Y	Y	N	< 1
Custer Battlefield	270060	Y	Y	Y	Y	Y	N	1
St Mary Ranger Stn	270560	Y	Y	Y	Y	^	^	1-5
Glacier NP FWS	270570	Y	Y	Y	Y	Y	Y	1
Havre	270740	Y	Y	Y	Y	Y	Y	1-2
Clancy	270760	Y	Y	Y	Y	Y	Y	1
Give-Out-Morgan	271340	Y	Y	Y	Y	Y	Y	< 1
Mead	281520	Y	Y	Y	Y	^	N	1
North Platte	281580	Y	Y	Y	Y	Y	N	1
Red Rock Canyon	290080	Y	Y	Y	Y	Y	Y	1
Saval Ranch	290140	Y	Y	Y	Y	Y	Y	1
Smith Valley	290360	Y	Y	Y	Y	Y	Y	1
Lehman Cave NM	290560	Y	Y	Y	Y	Y	Y	^
Hubbard Brook	300240	Y	Y	Y	Y	Y	Y	2
Washington Crossing	312980	Y	Y	Y	Y	Y	Y	1
Gila Cliff	320180	Y	Y	N	Y	Y	N	1

TABLE 10. SYSTEM CHECKS OF FIELD LABORATORY

Site Name	ID	Space Adequate	Lab Clean	Temp. Control	Proper Weighing Technique	Report Forms Complete	Rain Charts Fully Annotated	Days Elapsed Sample Removal To Shipment
Bandelier	320720	Y	Y	Y	Y	Y	N	1
Mayhill	320840	Y	Y	Y	Y	Y	N	1
Cuba NM	320980	Y	Y	Y	^	Y	N	^
Capulin Mountain	321280	Y	Y	Y	Y	Y	Y	7
Aurora	330860	Y	Y	Y	Y	Y	Y	2
Chautauqua	331000	Y	Y	Y	Y	Y	N	1-3
Huntington	332020	Y	Y	Y	Y	Y	N	< 1
Whiteface Mtn	332020	Y	Y	Y	Y	Y	Y	1-2
West Point	335141	Y	Y	Y	Y	Y	Y	1
Bennett Bridge	335240	Y	Y	Y	Y	Y	Y	1-2
Jasper	336500	Y	Y	Y	Y	Y	Y	1
Biscuit Brook	336840	Y	Y	Y	Y	Y	N	1
Lewiston	340320	Y	Y	Y	Y	Y	^	1
Coweeta	342500	Y	Y	Y	Y	Y	^	2
Piedmont Res Stn	343460	Y	Y	Y	Y	Y	Y	1
Clinton Crops	343560	Y	Y	Y	Y	Y	N	< 2
Jordan Creek	343600	Y	N	Y	Y	Y	^	1-3
Finley Farm	344160	Y	Y	Y	Y	Y	N	^
Clingman's Peak	344500	Y	Y	Y	Y	Y	Y	2
T.R. National Park	350700	Y	Y	Y	Y	Y	Y	1.5
Icelandic State Pk	350880	Y	Y	Y	Y	Y	Y	< 1
Woodworth	351180	Y	Y	Y	Y	Y	Y	< 1
Oxford	360900	Y	Y	Y	Y	Y	Y	1-2
Delaware	361760	Y	Y	Y	Y	Y	Y	2
Caldwell	364900	Y	Y	Y	Y	Y	N	< 1
Wooster	367160	Y	Y	Y	Y	Y	N	< 1
Salt Plain NWR	370060	Y	Y	Y	Y	Y	N	1
Great Plains	371740	Y	Y	Y	^	^	^	^
Clayton Lake	372580	Y	Y	N	Y	Y	Y	4
Goodwell	372920	Y	N	Y	Y	Y	Y	^
Alsea Guard	380200	Y	Y	Y	Y	Y	N	1
Hyslop Farm	380202	Y	Y	Y	Y	Y	N	1
Bull Run	380260	Y	Y	Y	Y	Y	N	1
Silver Lake	380980	Y	Y	Y	Y	Y	N	1
Andrews Forest	381020	Y	Y	Y	Y	Y	N	1

TABLE 10. SYSTEM CHECKS OF FIELD LABORATORY

Site Name	ID	Space Adequate	Lab Clean	Temp. Control	Proper Weighing Technique	Report Forms Complete	Rain Charts Fully Annotated	Days Elapsed Sample Removal To Shipment
Vines Hill	381120	Y	Y	N	Y	Y	N	2-3
Starkey Exp Stn	381800	Y	Y	Y	Y	Y	Y	< 1
Penn State	391520	Y	Y	Y	Y	Y	Y	1-2
Kane Exp Forest	392940	Y	Y	N	Y	Y	Y	1-2
Leading Ridge	394200	Y	Y	Y	Y	Y	Y	2
Milford	397220	Y	Y	N	Y	Y	N	1
El Verde	402020	Y	Y	Y	Y	Y	Y	1
Santee NWR	420680	Y	N	N	Y	N	^	1-2
Clemson	421880	Y	Y	Y	Y	Y	N	1
Huron Well Field	430061	Y	Y	Y	Y	Y	Y	< 1
Cottonwood	430880	Y	Y	Y	Y	N	Y	< 1
Walker Branch	440040	Y	Y	Y	Y	Y	N	2
GSMP-Elkmont	441100	Y	Y	Y	Y	Y	N	2
Giles Co	441140	Y	Y	Y	Y	Y	N	2
Hatchie NWR	441400	Y	Y	Y	Y	Y	Y	2
Muleshoe NWR	450250	Y	Y	Y	Y	Y	N	1
Beeville	450350	Y	Y	Y	Y	Y	N	< 3
K-Bar Big Bend	450425	Y	Y	Y	Y	N	Y	2
Attwater	451040	Y	Y	Y	Y	Y	Y	^
Sonora	451650	Y	Y	Y	Y	Y	N	1
Longview	452180	Y	Y	Y	Y	Y	Y	< 3
Guadalupe Mtns NP	452215	Y	Y	^	Y	Y	N	1
Forest Seed	453800	Y	Y	Y	Y	Y	Y	< 3
Throckmorton	455180	Y	Y	N	Y	Y	Y	1
Victoria	455350	Y	Y	Y	Y	Y	^	< 3
LBJ Nat Grassland	455640	Y	Y	Y	Y	Y	Y	1
Bryce Canyon	460110	Y	Y	Y	Y	Y	N	1
Logan	460120	Y	Y	Y	Y	Y	N	1
Green River	460281	Y	Y	Y	Y	Y	N	2
Bennington	470100	Y	Y	Y	Y	Y	N	2
Underhill	470180	Y	Y	Y	Y	Y	Y	2
Charlottesville	480060	Y	Y	Y	Y	Y	Y	^
Horton Stn	481300	Y	Y	Y	Y	Y	N	3
Big Meadows	482890	Y	Y	Y	Y	Y	Y	4
Loves Mill	483300	Y	Y	Y	Y	Y	Y	1

TABLE 10. SYSTEM CHECKS OF FIELD LABORATORY

Site Name	ID	Space Adequate	Lab Clean	Temp. Control	Proper Weighing Technique	Report Forms Complete	Rain Charts Fully Annotated	Days Elapsed Sample Removal To Shipment
Olympic NP	491410	Y	Y	Y	Y	Y	N	3
Sullivan Lake	491540	Y	Y	Y	Y	Y	^	21
Marblemount	491940	Y	Y	Y	Y	Y	N	1
La Grande	492180	Y	Y	Y	Y	Y	N	^
Palouse Farm	492420	Y	N	Y	Y	Y	Y	1
Babcock State Park	500460	Y	Y	Y	Y	Y	N	< 1
Parsons	501860	Y	Y	Y	Y	Y	N	1
Suring	512500	^	^	^	^	^	^	^
Lake Dubay	512800	Y	Y	Y	Y	Y	N	1
Trout Lake	513640	Y	Y	Y	Y	Y	N	2
Lake Geneva	513680	Y	Y	Y	Y	Y	^	^
Spooner	513700	Y	Y	Y	Y	Y	^	1
Snowy Range	520020	Y	Y	Y	Y	Y	Y	1
Sinks Canyons	520260	Y	Y	Y	Y	Y	Y	1
South Pass	520261	Y	Y	Y	Y	Y	Y	1-2
Pinedale	520680	Y	Y	Y	Y	Y	Y	1
Gypsum Creek	520681	Y	Y	Y	Y	Y	N	1-2
Newcastle	520820	Y	Y	Y	Y	Y	Y	< 1
Tower YNP	520860	Y	Y	Y	Y	Y	N	2-7
American Samoa	530190	Y	Y	Y	Y	Y	Y	1

TABLE 11. pH MEASUREMENT TECHNIQUES

Site Name	ID	Fill Hole Open	Distilled Water Rinses	Slope Adjust Used	Electrode Tip Protected
Blackbelt	011000	Y	Y	Y	Y
Sand Mtn	011020	Y	Y	Y	Y
Denali	020390	Y	Y	Y	Y
Oliver Knoll	030360	Y	Y	Y	Y
Grand Canyon	030370	Y	Y	Y	Y
Organ Pipe Cactus	030620	Y	Y	Y	Y
Warren	040260	Y	N	Y	Y
Caddo Valley	040380	Y	Y	Y	Y
Buffalo NR	041620	Y	Y	Y	Y
Fayetteville	042700	Y	N	Y	Y
Tanbark Flat	054200	Y	Y	Y	Y
Hopland	054540	Y	Y	Y	Y
Palomar	056820	Y	Y	Y	Y
Sequoia	057550	Y	Y	Y	Y
Montague	057680	Y	Y	Y	Y
Chuchupate	058501	Y	Y	Y	Y
Davis	058840	Y	Y	Y	Y
Yosemite	058850	Y	Y	Y	Y
Alamosa	060060	Y	Y	Y	Y
Las Animas	060180	Y	Y	Y	Y
Niwot Saddle	060220	N	Y	N	N
Mesa Verde	061530	Y	Y	Y	Y
Sand Spring	061560	Y	Y	Y	Y
Rocky Mtn Nat Park	061910	Y	Y	Y	Y
Loch Vale	061911	Y	Y	Y	Y
Buffalo Pass	061920	Y	Y	Y	Y
Manitou	062120	N	Y	Y	Y
Pawnee	062220	N	Y	Y	Y
Bradford Ft	100360	Y	Y	Y	Y
CIFANT	100380	Y	Y	Y	Y
Everglades	101190	Y	Y	Y	Y
Quincy	101400	Y	Y	Y	Y
Verna Well	104100	Y	Y	Y	Y
Bellville	112040	Y	Y	Y	Y
Ft Frederica	112380	Y	Y	Y	Y

TABLE 11 (cont). pH MEASUREMENT TECHNIQUES

Site Name	ID	Fill Hole Open	Distilled Water Rinses	Slope Adjust Used	Electrode Tip Protected
Georgia Stn	114140	Y	Y	Y	Y
Tifton ARS	115000	Y	Y	Y	Y
Mauna Loa	120080	Y	Y	Y	Y
Craters of the Moon	130343	Y	Y	Y	Y
Headquarters	130480	Y	Y	Y	Y
Reynold's Creek	131180	Y	Y	^	Y
Smith's Ferry	131500	Y	Y	Y	Y
Bondville	141160	Y	Y	Y	Y
Shabbona	141800	Y	Y	Y	Y
Argonne	141980	Y	Y	Y	Y
Southern Il Univ	143580	Y	Y	Y	Y
Salem	144740	Y	Y	Y	Y
Dixon Springs	146340	^	Y	Y	Y
Monmouth	147860	Y	Y	Y	Y
Huntington Res	152020	Y	Y	Y	Y
SW Purdue Ag Ctr	152260	Y	Y	Y	Y
Indiana Dunes	153421	Y	N	Y	Y
Purdue U Ag Farm	154100	Y	Y	Y	Y
Big Springs	160880	Y	Y	Y	Y
McNay Research Stn	162320	Y	Y	Y	Y
Farlington	170740	Y	Y	Y	Y
Konza Prairie	173120	Y	Y	Y	Y
Lake Scott	173280	Y	Y	Y	Y
Perryville	180360	Y	Y	Y	Y
LC Woods	182260	Y	Y	Y	Y
Clark State	183560	Y	Y	Y	Y
Land Btwn the Lakes	183860	Y	Y	Y	Y
Hill Farm	190620	Y	Y	Y	Y
Iberia	191260	Y	Y	Y	Y
SE Research Stn	193060	Y	Y	Y	Y
Acadia	200011	Y	Y	Y	Y
Caribou	200045	Y	Y	Y	Y
Presque Isle	200046	Y	Y	Y	Y
Bridgton	200275	Y	Y	Y	Y
Greenville	200935	Y	Y	Y	Y

TABLE 11 (cont). pH MEASUREMENT TECHNIQUES

Site Name	ID	Fill Hole Open	Distilled Water Rinses	Slope Adjust Used	Electrode Tip Protected
White Rock	210360	Y	Y	Y	Y
Wye	211320	Y	Y	Y	Y
NACL	220155	Y	Y	Y	Y
Cadwell Creek	220815	Y	Y	Y	Y
East	221325	Y	Y	Y	Y
U of MI Biol Stn	230920	Y	Y	Y	Y
Raco	230980	Y	Y	Y	Y
Houghton	232241	Y	Y	Y	Y
Isle Royale NP	232571	Y	Y	Y	Y
Kellogg Biol Stn	232660	Y	N	Y	Y
Pine River	235340	Y	Y	Y	Y
Marcell Stn	241660	Y	Y	Y	Y
Fernburg Stn	241840	Y	Y	Y	Y
Camp Ripley	242360	Y	N	Y	Y
SW Experimental Stn	242720	Y	Y	Y	Y
Clinton	251080	Y	Y	Y	Y
Meridian	251460	Y	Y	Y	Y
Coffeeville	253000	Y	Y	Y	Y
Ashland Wildlife	260380	Y	^	^	^
University Forest	260560	Y	Y	Y	Y
Custer Battlefield	270060	Y	Y	Y	Y
St Mary Ranger Stn	270560	Y	Y	Y	Y
Glacier NP FWS	270570	Y	Y	Y	Y
Havre	270740	Y	Y	Y	Y
Clancy	270760	Y	Y	Y	Y
Give-Out-Morgan	271340	Y	Y	Y	Y
Mead	281520	Y	Y	Y	Y
North Platte	281580	Y	Y	Y	Y
Red Rock Canyon	290080	Y	Y	Y	Y
Saval Ranch	290140	Y	Y	Y	Y
Smith Valley	290360	Y	Y	Y	Y
Lehman Cave NM	290560	Y	Y	Y	Y
Hubbard Brook	300240	Y	Y	Y	Y
Washington Crossing	312980	Y	Y	Y	Y
Gila Cliff	320180	Y	Y	Y	Y

TABLE 11 (cont). pH MEASUREMENT TECHNIQUES

Site Name	ID	Fill Hole Open	Distilled Water Rinses	Slope Adjust Used	Electrode Tip Protected
Bandelier	320720	Y	Y	Y	Y
Mayhill	320840	Y	Y	Y	Y
Cuba NM	320980	Y	^	Y	Y
Capulin Mountain	321280	Y	Y	Y	N
Aurora	330860	Y	Y	Y	Y
Chautauqua	331000	Y	Y	Y	Y
Huntington	332020	Y	Y	N	Y
Whiteface Mtn	332020	Y	Y	Y	Y
West Point	335141	Y	Y	Y	Y
Bennett Bridge	335240	Y	Y	Y	Y
Jasper	336500	Y	Y	Y	Y
Biscuit Brook	336840	Y	N	Y	Y
Lewiston	340320	^	^	^	^
Coweeta	342500	Y	Y	Y	Y
Piedmont Res Stn	343460	Y	Y	Y	Y
Clinton Crops	343560	Y	Y	Y	Y
Jordan Creek	343600	Y	Y	Y	Y
Finley Farm	344160	Y	Y	Y	Y
Clingman's Peak	344500	Y	Y	Y	Y
T.R. National Park	350700	Y	Y	Y	Y
Icelandic State Pk	350880	Y	Y	Y	Y
Woodworth	351180	Y	Y	Y	Y
Oxford	360900	Y	Y	Y	Y
Delaware	361760	Y	Y	Y	Y
Caldwell	364900	Y	Y	Y	Y
Wooster	367160	Y	Y	Y	Y
Salt Plain NWR	370060	Y	Y	Y	Y
Great Plains	371740	^	^	^	^
Clayton Lake	372580	Y	Y	Y	Y
Goodwell	372920	Y	N	^	Y
Alsea Guard	380200	Y	Y	Y	Y
Hyslop Farm	380202	Y	Y	Y	Y
Bull Run	380260	Y	Y	Y	Y
Silver Lake	380980	Y	Y	Y	Y
Andrews Forest	381020	Y	Y	Y	Y

TABLE 11 (cont). pH MEASUREMENT TECHNIQUES

Site Name	ID	Fill Hole Open	Distilled Water Rinses	Slope Adjust Used	Electrode Tip Protected
Vines Hill	381120	Y	Y	^	Y
Starkey Exp Stn	381800	N	Y	Y	Y
Penn State	391520	Y	Y	Y	Y
Kane Exp Forest	392940	Y	Y	Y	Y
Leading Ridge	394200	Y	Y	Y	Y
Milford	397220	Y	Y	Y	Y
El Verde	402020	Y	^	^	^
Santee NWR	420680	Y	Y	Y	Y
Clemson	421880	Y	Y	Y	Y
Huron Well Field	430061	Y	Y	Y	Y
Cottonwood	430880	Y	Y	Y	Y
Walker Branch	440040	Y	Y	Y	Y
Giles Co	441140	Y	Y	Y	Y
GSMP-Elkmont	441190	Y	Y	Y	Y
Hatchie NWR	441400	Y	Y	Y	Y
Muleshoe NWR	450250	Y	Y	Y	Y
Beeville	450350	Y	Y	Y	Y
K-Bar Big Bend NP	450425	Y	Y	Y	Y
Attwater	451040	Y	Y	Y	Y
Sonora	451650	Y	Y	Y	Y
Longview	452180	Y	Y	Y	Y
Guadalupe Mtns NP	452215	Y	Y	Y	Y
Forest Seed	453800	Y	Y	Y	Y
Throckmorton	455180	Y	Y	Y	Y
Victoria	455350	Y	Y	Y	Y
LBJ Nat Grassland	455640	Y	Y	Y	N
Bryce Canyon	460110	Y	Y	Y	Y
Logan	460120	Y	Y	Y	Y
Green River	460281	Y	Y	Y	Y
Bennington	470100	^	Y	Y	Y
Underhill	470180	Y	Y	Y	Y
Charlottesville	480060	Y	Y	Y	Y
Horton Stn	481300	Y	Y	Y	Y
Big Meadows	482890	Y	Y	Y	Y
Loves Mill	483300	Y	Y	Y	Y

TABLE 11 (cont). pH MEASUREMENT TECHNIQUES

Site Name	ID	Fill Hole Open	Distilled Water Rinses	Slope Adjust Used	Electrode Tip Protected
Olympic NP	491410	Y	Y	Y	Y
Sullivan Lake	491540	Y	Y	Y	Y
Marblemount	491940	Y	Y	Y	Y
La Grande	492180	Y	Y	Y	Y
Palouse Farm	492420	Y	Y	Y	Y
Babcock State Park	500460	Y	Y	Y	Y
Parsons	501860	Y	Y	Y	Y
Suring	512500	^	^	^	^
Lake Dubay	512800	Y	Y	Y	N
Trout Lake	513640	Y	Y	Y	Y
Lake Geneva	513680	Y	Y	Y	Y
Spooner	513700	Y	Y	Y	Y
Snowy Range	520020	Y	Y	Y	Y
Sinks Canyons	520260	Y	Y	Y	Y
South Pass	520261	Y	Y	Y	Y
Pinedale	520680	Y	Y	Y	Y
Gypsum Creek	520681	Y	Y	Y	Y
Newcastle	520820	Y	Y	Y	Y
Tower YNP	520860	Y	Y	Y	Y
American Samoa	530190	Y	Y	Y	Y

TABLE 12. CONDUCTIVITY MEASUREMENT TECHNIQUES

Site Name	ID	Inverted Cell Technique	Standard Tested Before H20	Distilled Water Rinse	Sample Rinse	Conductivity Values Corrected
Blackbelt	011000	N	Y	Y	Y	Y
Sand Mtn	011020	N	Y	Y	Y	Y
Denali	020390	Y	Y	^	Y	Y
Oliver Knoll	030360	N	Y	^	Y	Y
Grand Canyon	030370	Y	N	^	Y	Y
Organ Pipe Cactus	030620	Y	Y	^	Y	Y
Warren	040260	N	Y	^	N	Y
Caddo Valley	040380	N	Y	^	Y	Y
Buffalo NR	041620	Y	Y	^	Y	Y
Fayetteville	042700	N	Y	^	Y	Y
Tanbark Flat	054200	Y	Y	^	Y	Y
Hopland	054540	Y	Y	^	Y	Y
Palomar	056820	Y	Y	^	Y	Y
Sequoia	057550	Y	N	^	Y	Y
Montague	057680	Y	Y	^	Y	Y
Chuchupate	058501	Y	Y	^	Y	Y
Davis	058840	N	N	^	Y	Y
Yosemite	058850	Y	Y	^	Y	Y
Alamosa	060060	N	Y	^	Y	Y
Las Animas	060180	Y	Y	^	Y	Y
Niwot Saddle	060220	^	N	Y	N	Y
Mesa Verde	061530	Y	Y	^	Y	Y
Sand Spring	061560	N	Y	^	Y	Y
Rocky Mtn Nat Park	061910	Y	Y	Y	Y	Y
Loch Vale	061911	Y	Y	^	Y	Y
Buffalo Pass	061920	Y	Y	^	Y	Y
Manitou	062120	N	Y	^	Y	Y
Pawnee	062220	N	Y	Y	N	Y
Bradford Ft	100360	^	Y	Y	N	^
CIFANT	100380	^	Y	Y	Y	Y
Everglades	101190	^	Y	Y	Y	Y
Quincy	101400	N	Y	Y	N	Y
Verna Well	104100	N	Y	Y	N	Y
Bellville	112040	^	Y	Y	Y	Y
Ft Frederica	112380	N	Y	^	Y	Y

TABLE 12 (cont). CONDUCTIVITY MEASUREMENT TECHNIQUES

Site Name	ID	Inverted Cell Technique	Standard Tested Before H20	Distilled Water Rinse	Sample Rinse	Conductivity Values Corrected
Georgia Stn	114140	N	N	Y	N	Y
Tifton ARS	115000	N	Y	Y	N	Y
Mauna Loa	120080	Y	Y	^	Y	Y
Craters of the Moon	130343	Y	Y	^	Y	Y
Headquarters	130480	Y	Y	Y	N	Y
Reynold's Creek	131180	Y	Y	Y	N	Y
Smith's Ferry	131500	Y	Y	Y	N	Y
Bondville	141160	Y	Y	^	Y	Y
Shabbona	141800	N	Y	Y	Y	Y
Argonne	141980	N	N	Y	N	Y
Southern Il Univ	143580	N	Y	^	Y	Y
Salem	144740	N	Y	^	Y	Y
Dixon Springs	146340	N	Y	^	Y	Y
Monmouth	147860	Y	Y	^	Y	Y
Huntington Res	152020	Y	N	Y	N	Y
SW Purdue Ag Ctr	152260	Y	Y	Y	N	Y
Indiana Dunes	153421	Y	Y	Y	Y	Y
Purdue U Ag Farm	154100	Y	Y	Y	Y	Y
Big Springs	160880	Y	N	^	Y	Y
McNay Research Stn	162320	Y	Y	^	Y	Y
Farlington	170740	Y	Y	^	Y	Y
Konza Prairie	173120	Y	Y	^	Y	Y
Lake Scott	173280	N	Y	^	Y	Y
Perryville	180360	N	Y	Y	N	Y
LC Woods	182260	N	Y	Y	N	Y
Clark State	183560	N	Y	^	Y	Y
Land Btwn the Lakes	183860	Y	N	^	Y	Y
Hill Farm	190620	Y	Y	^	Y	Y
Iberia	191260	Y	N	^	Y	Y
SE Research Stn	193060	Y	N	^	Y	Y
Acadia	200011	Y	Y	Y	Y	Y
Caribou	200045	Y	Y	Y	N	Y
Presque Isle	200046	Y	N	Y	Y	Y
Bridgton	200275	^	N	Y	N	Y
Greenville	200935	Y	Y	Y	N	Y

TABLE 12 (cont). CONDUCTIVITY MEASUREMENT TECHNIQUES

Site Name	ID	Inverted Cell Technique	Standard Tested Before H2O	Distilled Water Rinse	Sample Rinse	Conductivity Values Corrected
White Rock	210360	Y	Y	^	Y	Y
Wye	211320	Y	Y	Y	Y	Y
NACL	220155	Y	Y	^	Y	Y
Cadwell Creek	220815	Y	Y	^	Y	Y
East	221325	N	Y	^	Y	Y
U of MI Biol Stn	230920	Y	Y	Y	Y	Y
Raco	230980	Y	N	Y	N	Y
Houghton	232241	Y	Y	^	Y	Y
Isle Royale NP	232571	Y	Y	^	Y	Y
Kellogg Biol Stn	232660	Y	N	Y	Y	Y
Pine River	235340	N	Y	^	Y	Y
Clinton	241080	N	Y	Y	Y	Y
Marcell Stn	241660	N	N	Y	N	Y
Fernburg Stn	241840	N	Y	Y	N	N
Camp Ripley	242360	N	Y	Y	N	Y
SW Experimental Stn	242720	Y	Y	^	Y	Y
Meridian	251460	N	Y	Y	N	Y
Coffeeville	253000	N	Y	Y	N	Y
Ashland Wildlife	260380	N	Y	^	Y	Y
University Forest	260560	N	Y	Y	Y	N
Custer Battlefield	270060	Y	Y	Y	N	Y
St Mary Ranger Stn	270560	^	^	^	^	^
Glacier NP FWS	270570	Y	Y	^	Y	Y
Havre	270740	Y	Y	^	Y	Y
Clancy	270760	Y	Y	^	Y	Y
Give-Out-Morgan	271340	Y	N	^	Y	Y
Mead	281520	N	Y	^	Y	Y
North Platte	281580	Y	Y	^	Y	Y
Red Rock Canyon	290080	Y	Y	^	Y	Y
Saval Ranch	290140	Y	Y	^	Y	Y
Smith Valley	290360	Y	Y	^	Y	Y
Lehman Cave NM	290560	Y	Y	^	Y	Y
Hubbard Brook	300240	N	Y	^	Y	Y
Washington Crossing	312980	Y	Y	Y	Y	Y
Gila Cliff	320180	N	Y	^	Y	Y

TABLE 12 (cont). CONDUCTIVITY MEASUREMENT TECHNIQUES

Site Name	ID	Inverted Cell Technique	Standard Tested Before H20	Distilled Water Rinse	Sample Rinse	Conductivity Values Corrected
Bandelier	320720	Y	Y	^	Y	Y
Mayhill	320840	Y	Y	^	Y	Y
Cuba NM	320980	N	Y	^	Y	Y
Capulin Mountain	321280	Y	N	^	Y	Y
Aurora	330860	N	N	Y	N	Y
Chautauqua	331000	N	Y	^	Y	Y
Huntington	332020	N	N	^	Y	Y
Whiteface Mtn	332020	N	Y	Y	Y	Y
West Point	335141	Y	Y	^	Y	Y
Bennett Bridge	335240	Y	Y	^	Y	Y
Jasper	336500	Y	Y	^	Y	Y
Biscuit Brook	336840	Y	Y	^	Y	Y
Lewiston	340320	^	^	^	^	^
Coweeta	342500	N	Y	Y	Y	Y
Piedmont Res Stn	343460	N	Y	Y	Y	Y
Clinton Crops	343560	Y	Y	Y	Y	Y
Jordan Creek	343600	Y	Y	Y	Y	Y
Finley Farm	344160	N	Y	Y	Y	N
Clingman's Peak	344500	N	Y	^	Y	Y
T.R. National Park	350700	Y	Y	^	Y	Y
Icelandic State Pk	350880	N	Y	^	Y	Y
Woodworth	351180	N	Y	^	Y	Y
Oxford	360900	N	Y	Y	Y	Y
Delaware	361760	N	Y	Y	N	Y
Caldwell	364900	Y	Y	Y	Y	Y
Wooster	367160	Y	Y	Y	Y	Y
Salt Plain NWR	370060	Y	Y	^	Y	Y
Great Plains	371740	Y	^	^	^	^
Clayton Lake	372580	Y	Y	^	Y	Y
Goodwell	372920	Y	Y	^	Y	Y
Alsea Guard	380200	N	N	Y	Y	Y
Hyslop Farm	380202	N	N	N	Y	Y
Bull Run	380260	Y	Y	Y	Y	Y
Silver Lake	380980	^	Y	Y	Y	Y
Andrews Forest	381020	Y	Y	Y	Y	Y

TABLE 12 (cont). CONDUCTIVITY MEASUREMENT TECHNIQUES

Site Name	ID	Inverted Cell Technique	Standard Tested Before H20	Distilled Water Rinse	Sample Rinse	Conductivity Values Corrected
Vines Hill	381120	Y	Y	Y	N	Y
Starkey Exp Stn	381800	Y	Y	Y	Y	Y
Penn State	391520	N	Y	Y	N	Y
Kane Exp Forest	392940	Y	Y	Y	Y	Y
Leading Ridge	394200	N	N	^	Y	Y
Milford	397220	Y	Y	^	Y	Y
El Verde	402020	Y	^	^	^	^
Santee NWR	420680	N	Y	Y	N	Y
Clemson	421880	N	Y	^	Y	Y
Huron Well Field	430061	Y	Y	^	Y	Y
Cottonwood	430880	Y	Y	^	Y	Y
Walker Branch	440040	Y	Y	Y	Y	Y
Giles Co	441140	N	Y	N	N	Y
GSMP-Elkmont	441190	Y	Y	Y	Y	Y
Hatchie NWR	441400	Y	Y	^	Y	Y
Muleshoe NWR	450250	Y	Y	^	Y	Y
Beeville	450350	^	Y	Y	Y	Y
K-Bar Big Bend	450425	Y	Y	^	Y	Y
Attwater	451040	N	Y	Y	Y	Y
Sonora	451650	Y	Y	^	Y	Y
Longview	452180	^	Y	Y	N	Y
Guadalupe Mtns NP	452215	Y	Y	^	Y	Y
Throckmorton	455180	N	Y	^	Y	Y
Forest Seed	455350	^	N	Y	Y	Y
Victoria	455350	Y	Y	Y	Y	Y
LBJ Nat Grassland	455640	N	Y	^	Y	Y
Bryce Canyon	460110	N	Y	^	Y	Y
Logan	460120	Y	Y	^	Y	Y
Green River	460281	Y	Y	^	Y	Y
Bennington	470100	N	Y	^	Y	Y
Underhill	470180	N	Y	^	Y	Y
Charlottesville	480060	^	N	Y	Y	Y
Horton Stn	481300	^	Y	Y	Y	Y
Big Meadows	482890	Y	Y	Y	Y	Y
Loves Mill	483300	N	Y	Y	Y	Y

TABLE 12 (cont). CONDUCTIVITY MEASUREMENT TECHNIQUES

Site Name	ID	Inverted Cell Technique	Standard Tested Before H20	Distilled Water Rinse	Sample Rinse	Conductivity Values Corrected
Olympic NP	491410	Y	Y	Y	Y	Y
Sullivan Lake	491540	Y	Y	Y	Y	Y
Marblemount	491940	^	Y	Y	N	Y
La Grande	492180	^	Y	Y	N	Y
Palouse Farm	492420	N	Y	^	Y	Y
Babcock State Park	500460	N	Y	Y	N	Y
Parsons	501860	N	Y	Y	Y	Y
Suring	512500	^	^	^	^	^
Lake Dubay	512800	N	N	Y	Y	Y
Trout Lake	513640	Y	N	Y	Y	Y
Lake Geneva	513680	Y	Y	Y	Y	Y
Spooner	513700	^	Y	Y	Y	Y
Snowy Range	520020	N	Y	^	Y	Y
Sinks Canyons	520260	Y	Y	^	Y	Y
South Pass	520261	Y	Y	^	Y	Y
Pinedale	520680	Y	Y	^	Y	Y
Gypsum Creek	520681	N	Y	^	Y	Y
Newcastle	520820	N	Y	^	Y	Y
Tower YNP	520860	Y	Y	^	Y	Y
American Samoa	530190	^	Y	^	Y	Y

Eliminating this step results in measuring a sample aliquot which had been diluted with deionized water therefore lowering the measured value. Twenty-six sites (13%) measured the standard, deionized water, and sample in the wrong order. NADP/NTN procedure requires the measurement of deionized water after the 75 µS/cm standard and before the precipitation sample to ensure there is no carry-over from the standard to the lower ionic strength rain sample. It was noted, however, that most sites using the wrong analysis order used an adequate deionized water rinse between the standard and sample measurements to prevent carry-over. Proper analysis procedures were always discussed with site operators whenever the need was evident.

Results of Field Site Analysis of Simulated Precipitation

Each field laboratory was asked to analyze a performance audit solution for conductivity and pH. These solutions were prepared by dilution of EPA-supplied performance test solutions; the audit value is that designated by EPA. Designated quality limits are ± 0.1 unit for pH and ± 4 µS/cm for conductivity. Table 13 summarizes the findings.

Figure 4 is a graph of the frequency distribution of pH test results. Eighty-seven percent of the laboratories had pH results within ± 0.1 unit of the designated value. The average difference was -0.014 ± 0.14 pH unit. Of the sites which exceeded the accuracy requirement, fifteen sites had faulty pH electrodes. Ten field laboratories (5%) obtained conductivity values which varied by more than ± 4 µS/cm from the designated value (see Figure 5). The average difference was -0.24 ± 2.66 µS/cm.

Figure 6 presents a graph of the distribution of results from the check of site balances. The balances are used to weigh the mass of precipitation collected by the Aerochem Metrics collector. The balances were checked with weights ranging from 800 to 3200 grams. As shown in Figure 6, 97 percent of the sites had errors of 5 grams over the range of test weights. In terms of precipitation, this translates into a measurement error due to balances of less than 0.003 inch of rain (where 1724 grams = 1 inch of rain for the Aerochem Metrics Collector).

TABLE 13. RESULTS OF FIELD SITE ANALYSIS OF SIMULATED RECIPITATION

	pH (pH units)			Conductivity (umhos/cm)			
Site Name	Site	Audit	Diff*	DI H20	Site	Audit	Diff*
Blackbelt	4.37	4.45	-0.08	^	20.2	19.0	1.20
Sand Mtn	4.58	4.45	0.13	1.2	13.0	19.0	-6.00
Denali	4.28	4.29	-0.01	2.0	24.6	24.2	0.40
Oliver Knoll	4.35	4.39	-0.04	1.4	16.5	20.2	-3.70
Grand Canyon	4.25	4.28	-0.03	1.6	21.3	24.2	-2.90
Organ Pipe Cactus	4.35	4.39	-0.04	1.5	20.6	20.2	0.40
Warren	4.20	4.28	-0.08	2.2	21.2	24.2	-3.00
Caddo Valley	4.31	4.28	0.03	1.4	20.6	24.2	-3.60
Buffalo NR	4.27	4.28	-0.01	2.1	23.8	24.2	-0.40
Fayetteville	4.31	4.28	0.03	0.1	23.8	24.2	-0.40
Tanbark Flat	4.32	4.28	0.04	1.0	23.5	24.2	-0.70
Hopland	4.30	4.28	0.02	2.6	25.5	24.2	1.30
Palomar	4.44	4.28	0.16	0.2	23.3	24.2	-0.90
Sequoia	4.29	4.28	0.01	1.0	26.7	24.2	2.50
Montague	4.23	4.28	-0.05	1.1	24.5	24.2	0.30
Chuchupate	4.27	4.28	-0.01	1.5	24.4	24.2	0.20
Davis	4.30	4.28	0.02	1.4	24.9	24.2	0.70
Yosemite	^	^	^	2.1	23.0	24.2	-1.20
Alamosa	4.31	4.30	0.01	0.8	19.0	20.2	-1.20
Las Animas	4.32	4.30	0.02	2.3	20.3	20.2	0.10
Niwot Saddle	^	4.39	^	1.6	17.3	20.2	-2.90
Mesa Verde	4.40	4.30	0.10	1.5	22.2	20.2	2.00
Sand Spring	4.10	4.30	-0.20	3.0	20.3	20.2	0.10
Rocky Mtn Nat Park	4.28	4.28	0.00	1.5	24.2	24.2	0.00
Loch Vale	4.31	4.30	0.01	1.1	19.2	20.2	-1.00
Buffalo Pass	4.39	4.30	0.09	1.9	21.9	20.2	1.70
Manitou	4.33	4.30	0.03	3.5	20.7	20.2	0.50
Pawnee	4.31	4.28	0.03	1.0	22.1	24.2	-2.10
Bradford Ft	4.00	4.28	-0.28	1.5	19.0	24.2	-5.20
CIFANT	4.29	4.28	0.01	1.9	20.5	24.2	-3.70
Everglades	4.39	4.28	0.11	1.9	19.1	24.2	-5.10
Quincy	4.27	4.28	-0.01	1.0	21.6	24.2	-2.60
Verna Well	4.24	4.28	-0.04	1.3	21.4	24.2	-2.80
Bellville	4.33	4.28	0.05	0.7	26.0	24.2	1.80
Ft Frederica	4.30	4.28	0.02	0.9	23.8	24.2	-0.40

* Difference = Site Value - Audit Value

TABLE 13 (cont). RESULTS OF FIELD SITE ANALYSIS OF SIMULATED PRECIPITATION

	pH (pH units)			Conductivity (umhos/cm)			
Site Name	Site	Audit	Diff*	DI H2O	Site	Audit	Diff*
Georgia Stn	^	^	^	1.2	21.4	24.2	-2.80
Tifton ARS	4.36	4.28	0.08	1.7	27.5	24.2	3.30
Mauna Loa	4.26	4.33	-0.07	0.7	26.1	25.6	0.50
Craters of the Moon	4.25	4.28	-0.03	1.3	24.7	24.2	0.50
Headquarters	4.47	4.39	0.08	1.3	19.0	20.2	-1.20
Reynold's Creek	4.36	4.39	-0.03	1.5	19.7	20.2	-0.50
Smith's Ferry	4.39	4.39	0.00	3.5	21.7	20.2	1.50
Bondville	4.31	4.28	0.03	^	25.0	24.2	0.80
Shabbona	4.43	4.39	0.04	1.9	18.2	20.2	-2.00
Argonne	4.37	4.39	-0.02	1.4	19.0	20.2	-1.20
Southern Il Univ	4.27	4.28	-0.01	3.3	24.5	24.2	0.30
Salem	4.28	4.28	0.00	2.7	23.6	24.2	-0.60
Dixon Springs	4.28	4.05	0.23	^	23.6	24.2	-0.60
Monmouth	4.24	4.28	-0.04	1.0	23.8	24.2	-0.40
Huntington Res	4.38	4.39	-0.01	1.9	20.5	20.2	0.30
SW Purdue Ag Ctr	4.39	4.39	0.00	5.9	22.6	20.2	2.40
Indiana Dunes	4.55	4.39	0.16	3.5	21.7	20.2	1.50
Purdue U Ag Farm	4.38	4.39	-0.01	1.1	19.7	20.2	-0.50
Big Springs	4.32	4.36	-0.04	1.8	21.7	21.1	0.60
McNay Research Stn	4.27	4.34	-0.07	1.3	25.4	24.3	1.10
Farlington	4.34	4.28	0.06	5.1	22.5	24.2	-1.70
Konza Prairie	4.34	4.28	0.06	0.8	21.0	24.2	-3.20
Lake Scott	4.35	4.28	0.07	1.5	24.8	24.2	0.60
Perryville	4.37	4.39	-0.02	0.9	17.3	20.2	-2.90
LC Woods	4.29	4.45	-0.16	2.1	17.5	19.0	-1.50
Clark State	4.29	4.28	0.01	1.4	25.1	24.2	0.90
Land Btwn the Lakes	4.27	4.28	-0.01	1.1	24.5	24.2	0.30
Hill Farm	4.26	4.28	-0.02	^	21.6	24.2	-2.60
Iberia	4.54	4.39	0.15	1.0	18.8	20.0	-1.20
SE Research Stn	4.54	4.39	0.15	1.0	18.8	20.0	-1.20
Acadia	4.00	4.39	-0.39	1.9	22.3	20.2	2.10
Caribou	4.40	4.39	0.01	2.2	20.9	20.2	0.70
Presque Isle	4.31	4.39	-0.08	1.7	22.0	20.2	1.80
Bridgton	4.39	4.39	0.00	2.5	22.6	20.2	2.40
Greenville	4.39	4.39	0.00	5.0	21.2	20.2	1.00

* Difference = Site Value - Audit Value

TABLE 13 (cont). RESULTS OF FIELD SITE ANALYSIS OF SIMULATED PRECIPITATION

	pH (pH units)			Conductivity (umhos/cm)			
Site Name	Site	Audit	Diff*	DI H20	Site	Audit	Diff*
White Rock	4.34	4.28	0.06	1.4	25.2	24.2	1.00
Wye	4.21	4.28	-0.07	3.1	22.3	24.2	-1.90
NACL	4.32	4.39	-0.07	2.2	20.7	20.2	0.50
Cadwell Creek	4.19	4.28	-0.09	1.4	24.4	24.2	0.20
East	4.34	4.39	-0.05	6.9	23.2	20.2	3.00
U of MI Biol Stn	4.39	4.39	0.00	0.9	21.1	20.2	0.90
Raco	4.35	4.39	-0.04	1.5	21.2	20.2	1.00
Houghton	4.40	4.40	0.00	1.4	20.8	21.1	-0.30
Isle Royale NP	4.40	4.40	0.00	2.2	20.0	21.1	-1.10
Kellogg Biol Stn	4.35	4.39	-0.04	1.0	19.8	20.2	-0.40
Pine River	4.12	4.33	-0.21	1.5	23.7	24.2	-0.50
Marcell Stn	4.28	4.28	0.00	1.5	19.3	19.0	0.30
Fernburg Stn	4.33	4.28	0.05	0.8	21.8	24.2	-2.40
Camp Ripley	4.30	4.28	0.02	0.8	23.8	24.2	-0.40
SW Experimental Stn	^	^	^	1.5	23.8	24.2	-0.40
Clinton	4.40	4.45	-0.05	1.8	24.0	24.2	-0.20
Meridian	4.41	4.45	-0.04	10.4	41.6	19.0	22.60
Coffeeville	4.49	4.45	0.04	2.3	19.8	19.0	0.80
Ashland Wildlife	4.30	4.28	0.02	0.8	22.5	24.2	-1.70
University Forest	4.33	4.39	-0.06	1.0	20.0	20.2	-0.20
Custer Battlefield	4.28	4.28	0.00	1.6	25.6	24.2	1.40
St Mary Ranger Stn	4.39	4.33	0.06	^	^	^	^
Glacier NP FWS	4.39	4.33	0.06	^	^	^	^
Havre	4.38	4.28	0.10	1.6	21.5	24.2	-2.70
Clancy	4.31	4.28	0.03	1.4	20.8	24.2	-3.40
Give-Out-Morgan	4.30	4.33	-0.03	4.2	27.3	24.3	3.00
Mead	4.26	4.28	-0.02	0.2	24.2	24.2	0.00
North Platte	4.32	4.28	0.04	2.7	25.3	24.2	1.10
Red Rock Canyon	4.27	4.28	-0.01	1.7	23.2	24.2	-1.00
Saval Ranch	4.33	4.28	0.05	1.0	25.2	24.2	1.00
Smith Valley	4.25	4.28	-0.03	1.6	24.0	24.2	-0.20
Lehman Cave NM	4.32	4.28	0.04	1.6	24.5	24.2	0.30
Hubbard Brook	4.36	4.39	-0.03	0.7	20.8	20.2	0.60
Washington Crossing	4.40	4.39	0.01	0.7	21.7	20.2	1.50
Gila Cliff	4.60	4.39	0.21	7.0	28.5	20.2	8.30

* Difference = Site Value - Audit Value

TABLE 13 (cont). RESULTS OF FIELD SITE ANALYSIS OF SIMULATED PRECIPITATION

	pH (pH units)			Conductivity (umhos/cm)			
Site Name	Site	Audit	Diff*	DI H20	Site	Audit	Diff*
Bandelier	4.21	4.28	-0.07	0.9	23.6	24.2	-0.60
Mayhill	4.38	4.39	-0.01	17.2	19.8	20.2	-0.40
Cuba NM	4.32	4.28	0.04	1.6	23.0	24.2	-1.20
Capulin Mountain	^	^	^	3.0	21.3	20.2	1.10
Aurora	4.02	4.39	-0.37	0.4	21.8	20.2	1.60
Chautauqua	4.36	4.28	0.08	1.6	23.2	24.2	-1.00
Huntington	4.16	4.28	-0.12	1.1	23.0	24.0	-1.00
Whiteface Mtn	4.39	4.39	0.00	0.6	16.5	20.2	-3.70
West Point	4.22	4.28	-0.06	1.0	24.9	24.2	0.70
Bennett Bridge	4.33	4.28	0.05	0.6	23.9	24.2	-0.30
Jasper	4.30	4.28	0.02	0.7	24.2	24.2	0.00
Biscuit Brook	4.36	4.28	0.08	2.1	24.0	24.2	-0.20
Lewiston	^	^	^	^	^	^	^
Coweeta	4.39	4.45	-0.06	1.1	17.0	19.0	-2.00
Piedmont Res Stn	4.40	4.39	0.01	1.5	18.4	20.2	-1.80
Clinton Crops	4.42	4.28	0.14	1.5	13.7	24.2	-10.50
Jordan Creek	4.29	4.32	-0.03	^	23.2	25.2	-2.00
Finley Farm	3.63	3.56	0.07	1.6	139.0	134.8	4.20
Clingman's Peak	4.32	4.40	-0.08	0.9	21.8	21.1	0.70
T.R. National Park	4.33	4.33	0.00	1.2	24.8	24.3	0.50
Icelandic State Pk	4.27	4.33	-0.06	2.1	22.0	24.3	-2.30
Woodworth	4.36	4.33	0.03	3.3	21.9	24.3	-2.40
Oxford	4.38	4.39	-0.01	1.5	18.8	20.2	-1.40
Delaware	4.38	4.39	-0.01	1.2	18.5	20.2	-1.70
Caldwell	4.40	4.39	0.01	1.0	19.1	20.2	-1.10
Wooster	4.40	4.39	0.01	1.0	19.1	20.2	-1.10
Salt Plain NWR	4.07	4.28	-0.21	4.3	23.9	24.2	-0.30
Great Plains	^	^	^	^	^	^	^
Clayton Lake	4.29	4.28	0.01	1.1	24.9	24.2	0.70
Goodwell	^	4.28	^	0.2	25.9	24.2	1.70
Alsea Guard	4.17	4.28	-0.11	1.4	18.4	24.2	-5.80
Hyslop Farm	4.17	4.28	-0.11	1.4	18.4	24.2	-5.80
Bull Run	4.26	4.28	-0.02	2.2	24.9	24.2	0.70
Silver Lake	4.29	4.28	0.01	^	22.0	24.2	-2.20
Andrews Forest	4.35	4.28	0.07	0.9	22.0	24.2	-2.20

* Difference = Site Value - Audit Value

TABLE 13 (cont). RESULTS OF FIELD SITE ANALYSIS OF SIMULATED PRECIPITATION

	pH (pH units)			Conductivity (umhos/cm)			
Site Name	Site	Audit	Diff*	DI H20	Site	Audit	Diff*
Vines Hill	^	^	^	2.7	18.2	20.2	-2.00
Starkey Exp Stn	4.37	4.39	-0.02	2.0	21.0	20.2	0.80
Penn State	^	^	^	0.5	19.7	20.2	-0.50
Kane Exp Forest	4.34	4.39	-0.05	1.1	19.2	20.2	-1.00
Leading Ridge	^	^	^	1.1	25.1	24.2	0.90
Milford	4.29	4.28	0.01	1.7	25.0	24.2	0.80
El Verde	4.40	4.30	0.10	2.2	20.0	20.2	-0.20
Santee NWR	4.29	4.28	0.01	0.9	24.5	24.2	0.30
Clemson	4.31	4.28	0.03	1.0	24.2	24.2	0.00
Huron Well Field	4.24	4.34	-0.10	1.8	25.2	24.2	1.00
Cottonwood	4.35	4.33	0.02	1.5	25.6	24.3	1.30
Walker Branch	4.53	4.45	0.08	0.9	18.1	19.0	-0.90
Giles Co	4.38	4.45	-0.07	1.3	22.2	19.0	3.20
GSMP-Elkmont	4.36	4.45	-0.09	1.2	19.2	19.0	0.20
Hatchie NWR	4.30	4.28	0.02	1.8	25.4	24.2	1.20
Muleshoe NWR	4.25	4.28	-0.03	^	24.6	24.2	0.40
Beeville	4.40	4.45	-0.05	1.6	18.7	19.0	-0.30
K-Bar Big Bend NP	4.35	4.39	-0.04	2.3	21.9	20.2	1.70
Attwater	4.47	4.45	0.02	-0.6	17.9	19.0	-1.10
Sonora	4.32	4.39	-0.07	^	^	20.2	^
Longview	4.31	4.45	-0.14	2.5	19.1	19.0	0.10
Guadalupe Mtns NP	2.96	4.39	-1.43	2.1	18.6	20.2	-1.60
Forest Seed	4.40	4.45	-0.05	1.6	26.6	24.2	2.40
Throckmorton	4.32	4.28	0.04	1.2	19.0	19.0	0.00
Victoria	3.98	4.45	-0.47	1.8	20.0	19.0	1.00
LBJ Nat Grassland	4.37	4.28	0.09	4.7	23.9	24.2	-0.30
Bryce Canyon	4.34	4.28	0.06	1.7	22.9	24.2	-1.30
Logan	4.32	4.28	0.04	1.1	23.6	24.2	-0.60
Green River	4.27	4.28	-0.01	1.5	26.3	24.2	2.10
Bennington	4.25	4.28	-0.03	2.0	22.4	24.2	-1.80
Underhill	4.39	4.39	0.00	2.3	21.0	20.2	0.80
Charlottesville	4.34	4.28	0.06	0.8	24.5	24.2	0.30
Horton Stn	4.35	4.28	0.07	1.0	21.0	24.2	-3.20
Big Meadows	4.27	4.28	-0.01	1.3	23.1	24.2	-1.10
Loves Mill	4.46	4.45	0.01	1.1	15.6	19.0	-3.40

* Difference = Site Value - Audit Value

TABLE 13 (cont). RESULTS OF FIELD SITE ANALYSIS OF SIMULATED PRECIPITATION

	pH (pH units)			Conductivity (umhos/cm)			
Site Name	Site	Audit	Diff*	DI H2O	Site	Audit	Diff*
Olympic NP	4.28	4.28	0.00	1.5	30.2	24.2	6.00
Sullivan Lake	4.42	4.39	0.03	1.3	21.2	20.2	1.00
Marblemount	4.33	4.28	0.05	4.3	25.1	24.2	0.90
La Grande	4.28	4.34	-0.06	^	21.0	23.6	-2.60
Palouse Farm	4.32	4.28	0.04	1.0	25.3	24.2	1.10
Babcock State Park	4.44	4.39	0.05	1.8	20.0	20.2	-0.20
Parsons	4.28	4.39	-0.11	1.1	18.7	20.2	-1.50
Suring	4.34	4.28	0.06	1.8	23.8	24.2	-0.40
Lake Dubay	4.30	4.28	0.02	0.8	23.6	24.2	-0.60
Trout Lake	4.37	4.28	0.09	1.1	23.3	24.2	-0.90
Lake Geneva	3.98	4.28	-0.30	1.1	27.2	24.2	3.00
Spooner	^	^	^	1.2	24.3	24.2	0.10
Snowy Range	4.43	4.30	0.13	0.7	18.5	20.2	-1.70
Sinks Canyons	4.27	4.28	-0.01	1.3	25.2	24.2	1.00
South Pass	4.27	4.28	-0.01	1.3	25.1	24.2	0.90
Pinedale	4.15	4.28	-0.13	1.6	24.8	24.2	0.60
Gypsum Creek	4.17	4.28	-0.11	1.8	21.5	24.2	-2.70
Newcastle	4.25	4.33	-0.08	1.3	21.3	24.3	-3.00
Tower YNP	4.34	4.28	0.06	1.6	21.2	24.2	-3.00
American Samoa	4.23	4.32	-0.09	4.6	25.6	23.2	2.40

* Difference = Site Value - Audit Value

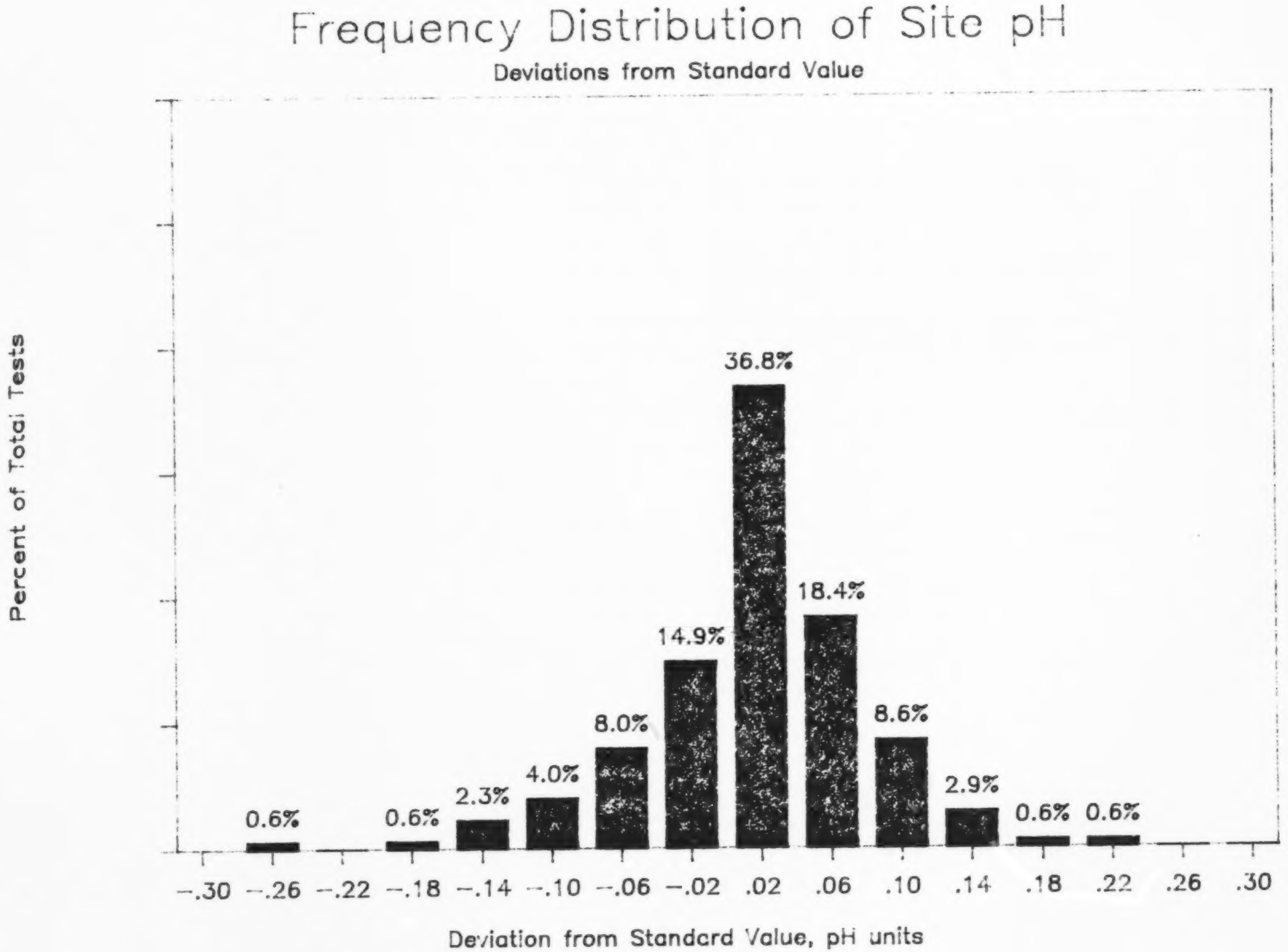

Figure 4. Frequency Distribution of Site pH Test Results.

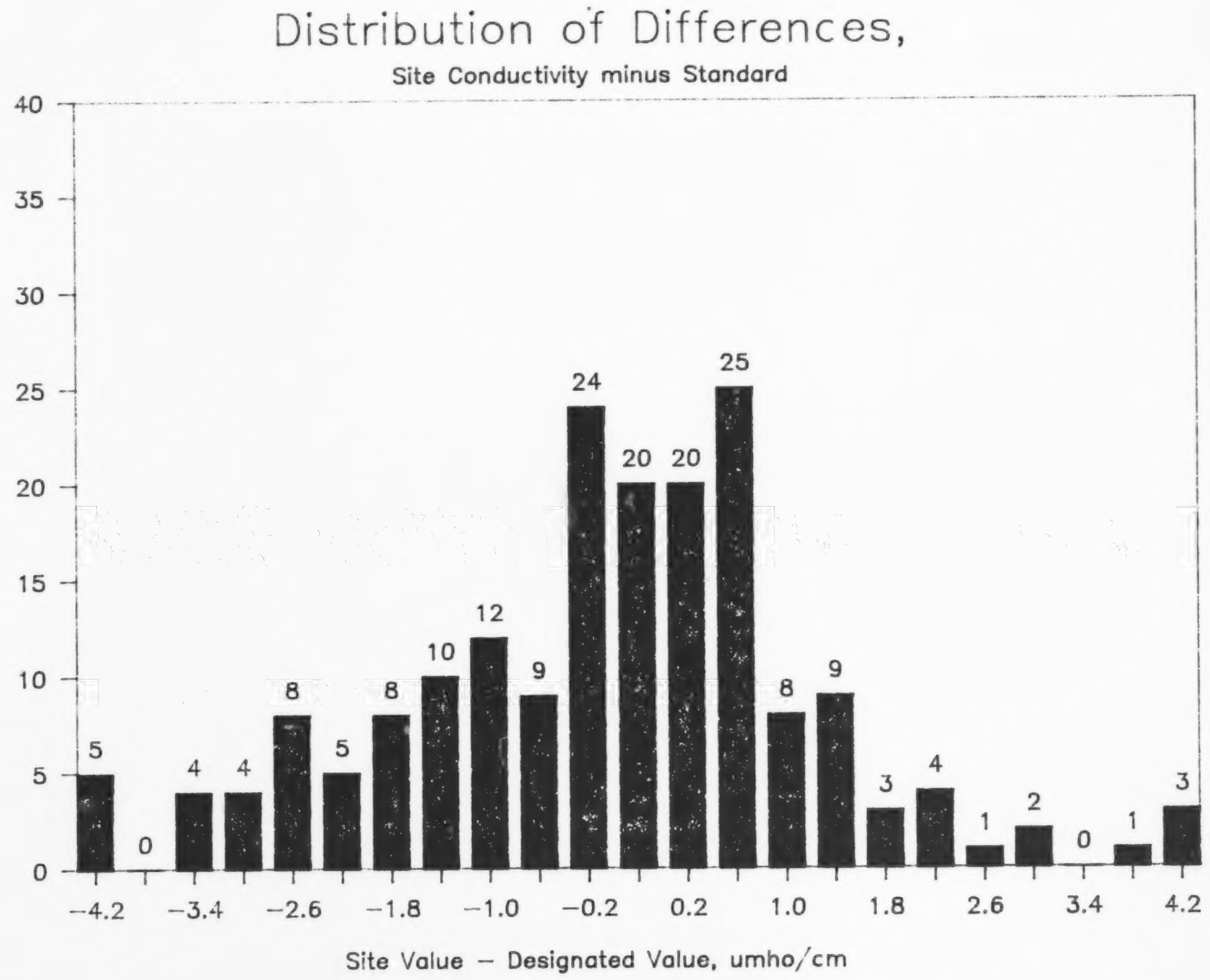

Figure 5. Distribution of Differences, Site Conductivity Minus Standard.

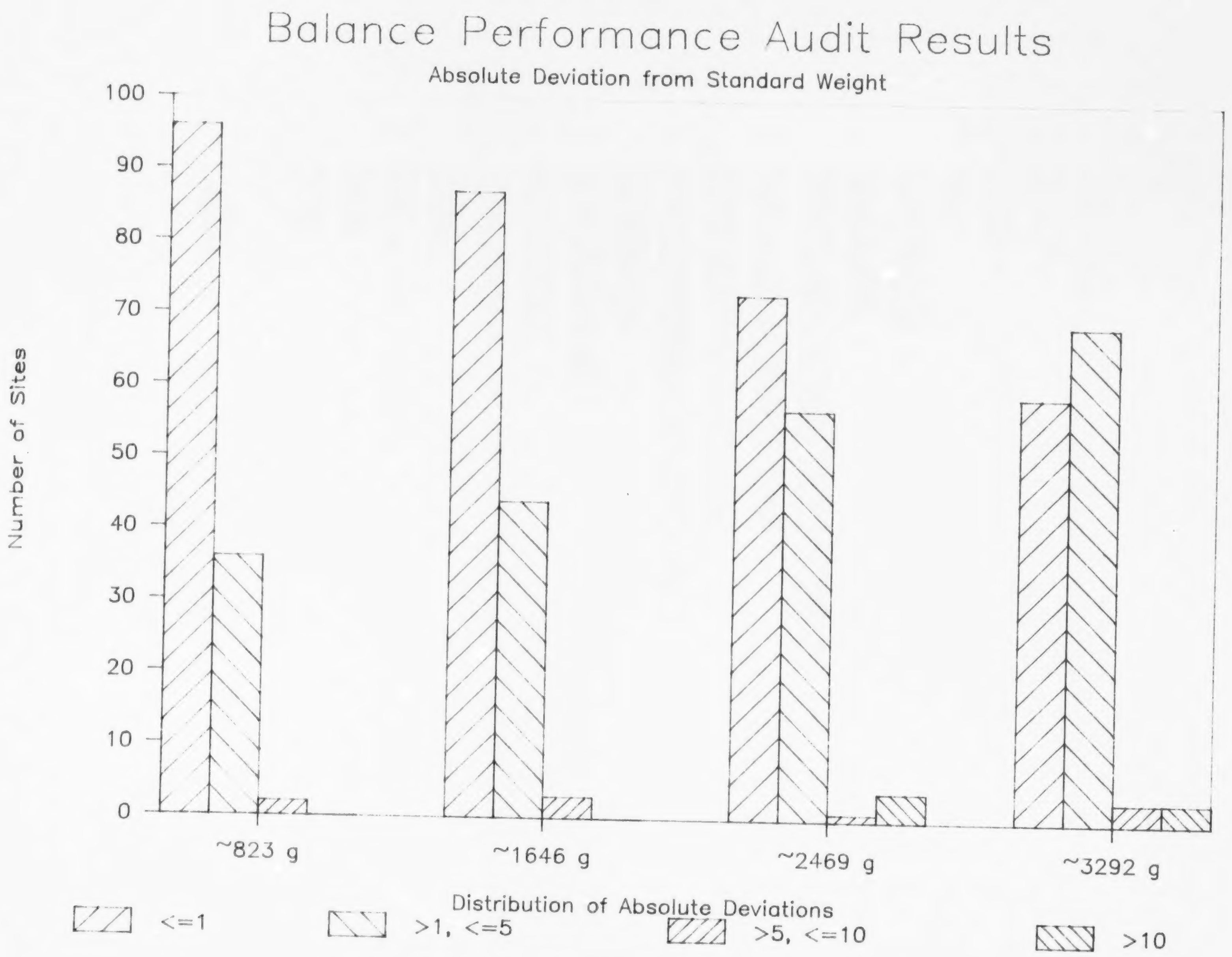

Figure 6. Balance Performance Audit Results.

SECTION 7

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APPENDIX A
NADP/NTN PRECIPITATION COLLECTION SITES; SITE SELECTION CRITERIA

Reprinted from Chapter 2 of "Instruction Manual:
NADP/NTN Site Selection and Installation."
D. S. Bigelow, Program Coordinator's Office,
National Atmospheric Deposition Program,
Fort Collins, CO. (July 1984)

2.0. SITE SELECTION

2.1. General Considerations

Monitoring sites for the networks are selected to represent major physiographic, agricultural, aquatic and forested areas within each cooperating state, region or ecoregion. Wherever possible, collection sites include locations where watershed, marine, freshwater, or other hydrological research is already underway, or where research is being conducted on nutrient cycling, air pollution, or atmospheric chemistry. Additional consideration is given on the basis of available knowledge of emission sources, prevalent forms of deposition, frequency of precipitation events and other meteorological and atmospheric processes that influence the deposition of substances in each area. This background information permits meaningful interpretations of spatial, seasonal, and temporal variations in the chemistry of wet and dry deposition both regionally and nationally.

2.2. Co-location With Other Programs

The co-location of monitoring equipment with other programs is encouraged. Some precautions, however, need to be observed when co-locating sampling or monitoring equipment.

Sampling sites can be overused to the point where one program becomes compromised by the addition of extra equipment. Besides violating the siting criteria outlined in Section 2.3., increased visitation to a site increases the chance of contamination to the sampling receptacles. Disturbances in air movement about the site by other than natural phenomena can reach a point where what is sampled is no longer representative of the region but only represents the local congested environment.

2.3. COLLECTOR and RAIN GAUGE Siting Criteria

2.3.1. Regional Requirements

The RAIN GAUGE and COLLECTOR should be located in an area that typifies a region and minimizes the impact of local point or area sources. However, if a region is characterized by a certain type of agricultural land use or industrialization, the COLLECTOR should be located to provide representation of such extensive deposition sources.

Specific sources of concern include industrial operations and suburban/urban area related sources. Industrial operations such as power plants, chemical plants, and manufacturing facilities should be at least 10 km away from the collector. If the emission sources are located in the general upwind direction (i.e., the mean annual west-east flow in most cases) from the COLLECTOR, then this distance should be increased to 20 km. This same criteria also applies to suburban/urban areas whose population approximates 10,000 people. For larger population centers (i.e., greater than 75,000) the COLLECTOR should be no closer than 20 km. This distance is doubled, to 40 km, if the population is upwind from the COLLECTOR. Beyond 50 km both industrial and urban sources are generally assumed to blend in with the typical characteristics of the region.

2.3.2. Local Requirements

Transportation related sources, agricultural operations, and surface storage of certain types of products are typically the most troublesome sources to identify and quantify once regional requirements for industrial sources have been met (Section 2.3.1). No moving sources of pollution, such as air, ground, or water traffic or the medium on which they traverse (e.g., runway, taxiway, road, tracks, or navigable river) should be within 100 meters of the COLLECTOR. The local road net around the site is of particular concern. Traffic volume and type will largely determine the impact of these types of sources on the site. Feedlots, dairy barns, etc., in which large concentrations of animals are housed should be no closer than 500 meters from the COLLECTOR. Grazing animals and pasture should be no closer than 20 meters from the COLLECTOR. Surface storage of agricultural products, fuels, vehicles, or other source materials should be kept at least 100 meters from the COLLECTOR. Parking lots and maintenance yards also need to be kept at least 100 meters from the collector. Local Sources, whether point, line or area sources, will greatly influence the suitability of a site to serve as a long-term regionally representative station. Land development in future years may further compromise the site's usefulness as a station. For these reasons, consideration should be given to alternate sites in the event that the original site is no longer representative of the region.

2.3.3. On Site Requirements

The site should be accessible in both summer and winter and be a low risk to vandalism. Further, the COLLECTOR and RAIN GAUGE should be sited to conform as nearly as possible with the following:

1. The COLLECTOR should be installed over undisturbed land on its standard 1-meter-high aluminum base. Naturally vegetated, level areas are preferred, but grassed areas and slopes up to ± 15% will be tolerated. Sudden changes in slope within 30 meters of the COLLECTOR should also be avoided.
   Ground cover should surround the COLLECTOR for a distance of approximately 30 meters. In farm areas, a vegetated buffer strip must surround the COLLECTOR for at least 30 meters.

2. Annual vegetation within the site should be maintained at less than two feet in height.

3. No object or structure shall project onto the COLLECTOR or RAIN GAUGE with an angle greater than 45° from the horizontal (30° is considered optimal, but 45° is the highest angle acceptable). Therefore, the distance from the sampler to the object must be at least equal to the height of the object (preferably twice the height of the object). Residential dwellings must be kept twice their height from the COLLECTOR (30°). Pay particular attention to anemometer towers and overhead wires (Figure 2.1).

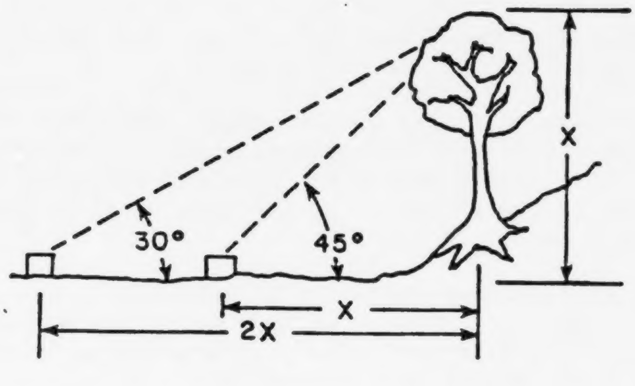

Figure 2.1

4. Residential structures within 30 meters of the COLLECTOR should not be within the 30° cone of the mean wind direction (Figure 2.2).

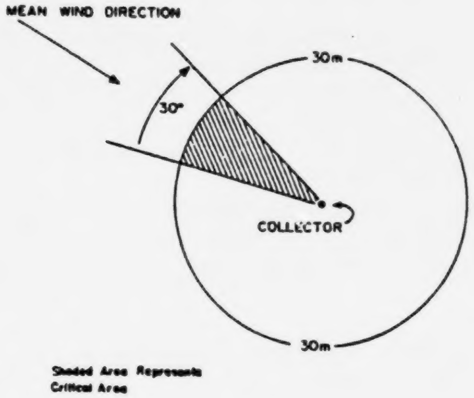

Figure 2.2

5. The base of the COLLECTOR should not be enclosed. Further, any object over 1 meter high with sufficient mass to deflect wind should not be located within 5 meters of the COLLECTOR. Alter wind shields and open fences are excluded from this requirement.

6. The RAIN GAUGE should be within 30 meters of the COLLECTOR but no closer than 5 meters. Its orifice should be located within one foot of the same plane as the orifice of the COLLECTOR. In snow accumulation areas, this may require a separate platform for the RAIN GAUGE.

7. In areas where more than 20% of annual precipitation is snow, RAIN GAUGES must be equipped with an alter wind shield. This shield should be installed such that the pivot axis of the shield is at the same level as the top of the RAIN GAUGE.

8. In areas having an accumulation of over 0.5 meters of snow per year, the COLLECTOR and RAIN GAUGE may be raised off the ground on a platform. The platform should be no higher than the maximum anticipated snow pack. In general, platforms are discouraged. Note: The 5 meter separation between the RAIN GAUGE and COLLECTOR must be maintained (Item 6).

9. COLLECTORS located in areas which normally receive snow should have a properly counterweighted snow roof installed on the moving lid of the COLLECTOR only if problems with the opening and closing are encountered. If installed, the roof will be left on year round.

10. Changes or modifications to established or approved sites or to its equipment must be submitted to the Program Coordinator's Office prior to implementation. This includes moving the site, siting other equipment in close proximity to the existing COLLECTORS (30 meters), installation of snow roofs, etc. In the event additional equipment is added to the site or a change in location becomes necessary, the following information is needed:
    a) A brief letter to the Program Coordinator's Office requesting the change and documenting its need.
    b) Sites moving within the 30 meters surrounding the original location of the collector will be required to file a new site sketch with pictures and negatives, along with a letter stating when and why the site was moved.
    c) Sites moving greater than 30 m but less than 10 km will be required to file a new Site Description Questionnaire, site sketch map, and pictures with negatives. A new topographical map will be required only if the site moves off the old quad.
    d) Sites moving further than 10 km or into a different type of topography, ecoregion or land use must reapply for admission to the network as a new site. Such a move requires submission of a complete set of siting documents to the Coordinator's Office for approval. A new site name, CAL code and station number will be assigned to the new site.

11. All COLLECTOR location changes (orientation, moves on or off platforms, elevation, short moves, long moves, etc.) will be documented so that data users have the ability to determine if a change in data correlates with some physical change at the site.

2.4. Classification of Network Sites: Operational Status

Once a site has been identified, sites will be classified into one of three levels:

Provisional

Each site will be initially classified Provisional based upon the information provided with the Site Description Questionnaire, if the questionnaire has been properly completed. Pictures showing the COLLECTOR in place, topographical map and a site drawing are required to obtain Provisional status.

Interim

Interim status will be given to those sites which after visitation by a network site reviewer are verified as having met all of the siting criteria outlined in Section 2.3 of this manual and as having all of the required sampling equipment including the Aerochem Metrics or equivalent WET/DRY precipitation COLLECTOR; the weighing, recording RAIN GAUGE equipped with an EVENT RECORDER; the pH and conductivity meters and a 20 kg capacity balance. If a representative of the Coordinator's Office installs the site, then Interim status may be granted at the time of installation.

Certified

Final certification will be made after several years of routine operation of each site.

Sites will become Certified when data analysis determines that the site is operating according to established protocol and that the site is a regionally representative site not significantly biased by local sources.

APPENDIX B
NADP/NTN FIELD SITE SYSTEMS AND PERFORMANCE SURVEY QUESTIONNAIRES

SYSTEMS AND PERFORMANCE SURVEY QUESTIONNAIRE: FIELD

Site Characteristics

Identification.

101 Site name ______ ID # ______
102 Site supervisor ______
103 Site operator ______
104 Other site operators ______
105 Telephone ______
106 Mailing address ______
______
107 Shipping address ______
______
108 Date of site audit visit ______
109 Time of site audit visit ______
Weather condition during time of site visit
110 Sky (circle one) clear overcast cloudy ______
111 Wind (circle one) calm gusty sustained wind ______
112 Precipitation (circle one) none fog mist rain
sleet snow ______
113 RTI auditor's signature ______
114 Is this an NADP site? ______ An NTN site? ______
115 Has site operator or supervisor attended CAL course? ______
116 How long has operator been site operator? ______

Logistics.

		Yes	No
	Is the site accessible		
117	in summer?		
118	in winter?		

119 How far from the nearest road is the precipitation collector? ______ (m)
120 Type of road surface? ______
121 How close to the collector does the operator park his vehicle? ______ (m)

Topography and Land Use.

Explain all yes answers in comments at the end of this section and draw brief sketch of site.

		Yes	No
Within 30-m			
122	Is the slope greater than 15 degrees?	___	___
123	Is the ground cover other than natural vegetation and/or more than 2 feet high?	___	___
124	Are there plowed fields or tilled areas?	___	___
125	Is there equipment present other than the specified rain gauge and collector?	___	___
126	Are there grazing animals?	___	___
127	Are there any objects (solar panel, rain gauge, etc.) close to the collector or rain-gauge which might deflect the wind? Describe on sketch.	___	___
Within 100-m			
128	Are there any objects (trees, overhead wires, etc.) which project on the collector or rain gauge with an angle greater than 45° from horizontal?	___	___
129	Are there storage facilities for chemicals, vehicles, etc.?	___	___
130	Are there sources of frequent ground, water, or air traffic?	___	___
Within 500-m to 50-km (i.e., within 30 miles)			
131	Are there large concentrations of animals such as feedlots, dairy barns, kennels, etc. within 500-m? (1600 feet)	___	___

		Yes	No
132	Are there industrial operations such as factories, chemical plants, sewage treatment plants, etc. within 10-km? (6 miles)	___	___
133	Are there up-wind industrial operations within 20-km? (12 miles)	___	___
134	Are there suburban or urban areas containing more than 10,000 people within 10-km? (6 miles)	___	___
135	Are there upwind suburban or urban areas containing more than 10,000 people within 20-km? (12 miles)	___	___
136	Are there cities containing more than 75,000 people within 20-km? (12 miles)	___	___
137	Are there upwind cities within 40-km? (25 miles)	___	___

Comments:

Sketch of NADP/NTN Field Site

N

W

E

S

Site Name ____________________

Site Number ____________________

Date of Visit ____________________

Name of Surveyor ____________________

Scale ____________________

Draw additional sketches on back of preceeding pages.

Aerochem Metrics Sampler

Yes No

System Check.

201 Model # ____________ ID # ____________

202 What type of power does collector have? (circle)
(a) AC only
(b) AC with aerochem trickle changer/battery
(c) battery only
(d) battery with external AC powered charger
(e) Solar
(f) Other ________

If Solar Power, Enter 203 thru 206:

203 Manf. ____________________ Model ________

204 Number panels __________ Area of each ________

205 Panels facing __________ Angle from horz. _____

206 List any objects that may shade panels during hours of 8 am to 4 pm. ____________________

207 Is there evidence of battery electrolite spillage? ___ ___

208 Has collector failed to operate during last year because of a power failure? ___ ___

209 Is the collector on a platform? ___ ___

210 How high is platform? _____ in.

211 Is the height above ground standard ___ ___

212 Is collector level? ___ ___

213 Is collector stable? ___ ___

214 Is the collector standard, base not enclosed? ___ ___

215 What is the collector orientation (wet bucket is to N S E W)? ________

216 Is the precipitation sensor old or new type? ________

217 Is screw head of sensor orientated away from dry bucket? ___ ___

218 Is sensor clean? ___ ___

Yes No

219 Is sensor gap between baseplate and grid constant? ___ ___

220 What is the sensor gap distance? ________ in. ________ mm

221 Are buckets installed properly? ___ ___

222 Are buckets held with tie down strap (springs)? ___ ___

223 Is the lid in correct wet/dry position? ___ ___

Does The Collector Have

224 Aluminum snow roof? ___ ___

225 Polycarbonate snow roof? ___ ___

226 Polycarbonate lid cover? ___ ___

227 Heated lid pad ___ ___

228 Other ____________ ________

229 Snow roof orientated properly? ___ ___

230 How many counter weights does collector have? ________

231 What are their sizes? 2 x ____ 2 x ____ 2 x ____ 2 x ____

232 Are counter weights correct for type lid? ___ ___

233 What is the clutch type, 1" or 1.5"? ________

234 Is the clutch face worn? ___ ___

235 Are the alignment of bars ok? ___ ___

236 What is the collector distance from rain gauge? ________ ft ________ m

237 Is the collector bucket rim within ±0.3 M (12 inches) of the same height as the top of the Belfort gauge? ___ ___

238 Is collector connected to rain gauge event marker? ___ ___

Performance Check.

239 Measure temperature of sensor at 1/3 from top. ________ °C

240 Measure output voltage to rain gauge while closed. ________ V

241 Tenson to lift lid slightly with spring scale. ________ g

242 Measure distance of lid from base with bucket in ________ mm

243 Does the lid seat properly on wet bucket? ___ ___

Yes No

Add several drops of water to sensor plot near top of sensor grid.

244 How long (seconds) does it take for the bucket cover to move from wet to dry bucket. ____ sec

245 Does sampler open smoothly and come to rest on dry bucket? ___ ___

246 Does it stay there on dry bucket? ___ ___

247 Does the lid seat properly on dry bucket? ___ ___

Observe condition of underside of bucket cover. Does it have:

248 Split polyethylene or degraded polyurethane ___ ___

249 Dirt or mildew? ___ ___

250 Measure output voltage to rain gauge while open. ______ V

251 What is the maximum sensor temp. observed after 5 to 10 min. ______ min ______ °C

Remove Wet Bucket

252 Blow off water. Does bucket cover return to wet side? ___ ___

253 Measure distance of lid from base with wet bucket removed. ____ mm

254 Difference of (241) ____ mm - (252) ____ mm = ____ mm
IF Diff < 3 mm (1/8") determine why?

255 How many Belfort gauge test weights will bucket cover lift when sensor is activated? (3 max.) ______

256 Is clutch OK? ___ ___

257 Test sensor with series of resistors until one opens the bucket. Open value. ____ k

258 Does sensor: ______

A. Heat continuous

B. Not heat

C. Operate properly

Quiz operator about collector's past operation. Take this information down, along with your observations and:

(1) Make necessary simple adjustments or repairs. Explain below what you did. Verify operation by retesting.

(2) Make recommendations for more extensive repair. Explain below.

(3) Guide operator through S. Dossett's troubleshooting manual if there are questions.

Operator or Site Visitor Comments.

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(1) Make necessary simple adjustments or repairs. Explain below what you did. Verify operation by retesting.

(2) Make recommendations for more extensive repair. Explain below.

(3) Guide operator through S. Dossett's troubleshooting manual if there are questions.

Operator or Site Visitor Comments.

Belfort Rain Gauge

301 Model # ____________ S/N ______________

		Yes	No
System Check.			
302	Is the gauge level?	___	___
303	Is the gauge stable?	___	___
304	Is the collection bucket level?	___	___
305	Is the opening round?	___	___
306	Is gauge top approximately 1.5 m (59") ± 0.5 m (20") above ground?	___	___
307	If gauge is on a platform, describe the size, height of platform.	________	
308	What is rain gauge distance from sampler? _____ft	______m	
309	Is the access door of the rain gauge on the down wind side of the predominant wind path?	___	___
310	Does the rain gauge have an alter shield?	___	___
311	If rain gauge is inoperative, how does operator obtain daily/weekly precipitation information? ______________________________		
312	Is there a back-up rain gauge within a half mile (805 m)? distance _______ direction _______	___	___
313	Does site have NADP sand bottle weights?	___	___
314	Is the rain gauge calibration checked twice per year?	___	___
315	In winter, is the funnel removed and is an antifreeze and/or oil mixture put in bucket?	___	___
316	Except during winter when antifreeze is present, is catch bucket emptied every Tuesday?	___	___
317	Is the catch bucket corroded or dirty?	___	___
318	Is excessive dust present inside the gauge?	___	___

		Yes	No
319	Is the pen recording a clear trace?		
320	Is the pen offset one day on the chart as recommended by NADP?		
321	Is the gauge pen (not even pen) set to correct time?		
322	Is the pen located at the correct hour of the day, expressed as local time, within ± 1 hour? Give hour ____________.		
323	Are event marks made when the sampler opens and closes?		
324	How many hours difference are there between the event marker and the correct time?		
325	Is the clock ticking?		
326	Is clock battery operated?		
327	Dampening fluid level approximately 0.25 in from top?		
328	Are zero adjustments made using both coarse and fine knobs?		
329	Does the pen traverse the chart time line within ± 1 hour?		
330	Is gauge in cal (error < .1").		
331	Point where error is .1" or greater.		
332	Gauge calibrated by RTI.		

Calibration Check.

Have the site operator remove the top cover of the gauge, exposing the collection bucket. Jiggle the bucket to cause a deflection of the pen and enter initials, date, and "removed for audit" on the chart. Store chart. Have operator remove the recorder drum and install a new chart. Label the new chart with the site name, date, and time and the auditor's initials. Remove the collection bucket, install the weight support device, and zero the pen on the chart.

(1) Proceed to test the response of the rain gauge to various test weights as follows.

a. Rotate the drum by hand for approximately 0.25 inch and mark the chart reading as "baseline."

b. Carefully place calibrated weights, each equivalent to 1 inch rain, on the weight support and rotate the drum after each weight. Use a total of 12 weights.

c. If the response at any loading differs by more than 0.1 inch from expected value, calibrate the gauge.

(2) Zero the pen on the chart repeat (1).

Remove the audit chart and have station operator replace the original chart on the drum and set the pen to the correct day and hour. Transfer results from gauge chart to Table A-1.

Enter Comments her and/or on Table A-1. ______________________

____

____

____

____

____

TABLE A-1. RESULTS FOR BELFORT RAIN GAUGE CHECK

Site # ______________________ Site Name ______________________
301 Belfort Gauge Model # ______________ S/N ______________________
Date of Visit ______________________
333 Gauge Calibrated by RTI Yes ___ No ___

NO ADJUSTMENT

Sum of Audit Weights, Inches	Gauge Chart Reading, Inches	Difference Inches
baseline		
1.0		
2.0		
3.0		
4.0		
5.0		
6.0		
7.0		
8.0		
9.0		
10.0		
11.0		
12.0		

PEN SET TO CHART ZERO

Sum of Audit Weights, Inches	Gauge Chart Reading, Inches Before Calib.	Difference Inches
baseline		
1.0		
2.0		
3.0		
4.0		
5.0		
6.0		
7.0		
8.0		
9.0		
10.0		
11.0		
12.0		

Sample Collection Procedures

Sample Handling.

		Yes	No
401	Does operator approach sampler from downwind direction?	___	___
402	Is the sample bucket changed if, after seven days, no precipitation has occurred?	___	___
403	Does the operator check the collector weekly, noting lid movement check on Belfort chart?	___	___

Have operator describe procedure followed during a bucket change. Answer the following questions.

		Yes	No
404	Is bucket checked for contamination before removal?	___	___
405	Is bucket or top held only on outside surface?	___	___
406	Is open bucket ever placed on the ground?	___	___
407	Is lid placed on bucket before removal?	___	___
408	Is bucket top securely attached before transporting sample to home laboratory?	___	___
409	Is bucket placed in plastic bag and then in shipping box before transport to the field laboratory?	___	___

Comments ____

____

____

____

Systems Check of Field Laboratory

		Yes	No
501	Is there adequate space for operation?	___	___
502	Is the space around the balance, pH and conductivity meters clean and free from dust, paint flakes, household chemicals?	___	___
503	Is the laboratory temperature controlled between 18 (64.4°F) and 25°C (77.0°F)?	___	___
504	Are the samples kept from direct sunlight during analysis?	___	___
505	Is equipment secure and protected from tampering?	___	___
Are the following manuals and leaflets available?			
506	Sample Collector Manual	___	___
507	Belfort Rain Gauge Manual	___	___
508	pH Meter Manual	___	___
509	pH Electrode Leaflet	___	___
510	Conductivity Cell Leaflet	___	___
511	Balance Manual	___	___
512	Field Operator's Manual - NADP	___	___
513	Letter Updates to Field Operator's Manual	___	___
514	Battery Charger Instructions (if used)	___	___
Are the following items present at the field laboratory?			
515	pH meter with electrode	___	___
516	Conductivity meter and cell	___	___
517	Balance	___	___
518	Wash bottle	___	___
519	Test tubes, polypropylene	___	___
520	How many clean buckets with mailing boxes on hand?	______	
521	Does operator rotate these? (first in, first out)	___	___

Yes No

Are the following reagents and test solutions present and properly stored?

522 Distilled or deionized water ___ ___

523 Standard KCl solution, 75 μmho/cm ___ ___

Note preparation date ______

524 pH 4.01 buffer solution ___ ___

525 pH 7.00 buffer solution ___ ___

526 Are pH buffers stored at room temperature? ___ ___

527 pH electrode test solution ___ ___

Note preparation date ______

528 Is the pH electrode test solution stored at room temperature? ___ ___

529 pH electrode filling solution ___ ___

530 Has operator incorporated any item into his laboratory procedure not specified in the NADP Operator's Manual? If yes, describe. ______________ ___ ___

____

531 Does operator weigh sample, lid, and contents before removing aliquot? ___ ___

532 Does operator know the minimum amount of sample required before doing a site analysis? (70-75 mL) ___ ___

533 How much time elapses between sample bucket removal and shipment? ______

534 Operator's contact for technical questions? ______

535 Operator's contact for shipping problems, supplies? ______

536 Types of technical problems encountered and how they were resolved? ______________________________

____

____

____

Inspect the FORF and rain gauge charts for past 10 weeks. Complete Table A-2.

TABLE A-2. RECORDS CHECK

Date Bucket Off	Rain Gauge Precip. in.	Sample Weight Precip. in.	Cond. Distilled Water µS/cm	Cond. Correction Factor	Cond. Sample µS/cm	pH Check Sample	pH Precip. Sample

Compare a FORF with corresponding rain gauge chart.

FORF Precip. record Bucket On ____________ Bucket Off ____________

	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.	Mon.	Tue.
Site Values								
Rain gauge chart								
Survey Values								

	Yes	No
Records Check.		
537 Are copies of Field Observer Report Forms (FORF) kept on file?		
538 Examine FORFs. Are they filled in completely?		

		Yes	No
537	Are the FORF entries legible and neat, with no erasures, and errors removed by one line through original data?	___	___
540	Does operator know how to request additional supplies?	___	___
541	Are copies of Belfort rain gauge charts kept on file?	___	___
Are charts documented with:			
542	Date and time of chart installation?	___	___
543	Date and time of chart removal?	___	___
544	Site identification?	___	___
545	Event marks?	___	___
546	Time adjustments?	___	___
547	Compare FORF entries to rain gauge chart amounts as determined by the RTI representative. If there are any noted discrepancies enter on Table 2.	___	___
548	Have the test solutions been measured each time?	___	___
549	Does the measured pH agree with the stated pH within 0.1 pH unit in each instance?	___	___

550 When agreement within specifications is not found, what action does the site operator take? ______________________

____

		Yes	No
551	Does the site operator have a file of all memoranda and letters issued concerning field operations?	___	___
552	Does the site operator have any questions about the contents of the memoranda and letters?	___	___

553 If question 7 is answered "yes", list the question(s) and the pertinent memoranda or letter. ______________________

		Yes	No
554	Does the operator have any questions concerning the quarterly USGS audit of pH and conductivity?	___	___

Comments ____

____

pH

The auditor is to ask the site operator to determine the pH of test solutions in exactly the same way as for a precipitation sample. The auditor is to give the operator the following test solution (contained in a polyethylene bottle) for testing.

- o Solution of simulated precipitation, the same one(s) used to test conductivity meter.

The auditor is to observe the operator carry out his standard procedure for determining pH as given in Section 3.3.3 of Reference (4). The auditor is to allow the site operator to work alone and is to answer the following questions concerning the operator's adherence to standard procedures for calibration of the pH meter and testing of samples.

Data from test to be entered by site operator on a FORF as a normal rain sample.

TABLE A-3. SURVEY RESULTS FOR pH

601 Site pH Meter: Make ________ Model ________
602 Site pH Electrode: Make ________ Model ________

Solution	Site Value (pH units)	Expected or Audit Value (pH units)	Difference (Site-Audit)
603 Site's H_2SO_4 Check Sol'n			
604 Simulated Rain Sample __			

		Yes	No
605	Is electrode furnished by CAL?		
606	How is the pH electrode stored between analysis sessions?		
607	Is pH electrode properly connected to the rear of the meter?		
608	Is the electrolyte fill hole of the electrode open during analysis.		
609	Does the operator rinse the electrode in deionized water and blot off drops prior to use?		

		Yes	No
610	Is meter standardized with pH 7 buffer solution by adjusting STANDARDIZE control?	___	___
611	Is meter response to pH 4 buffer set by adjusting SLOPE control?	___	___
612	Is electrode rinsed with deionized water and blotted between pH 7 and 4 buffers?	___	___
613	Is electrode tip kept from contact with bottom of test tube?	___	___
614	Does site use the 4 ml standard test tubes?	___	___
615	Is pH of electrode test solution determined using two aliquots of solution.	___	___
616	Are any adjustments made to pH meter?	___	___
617	Do at least 2-3 minutes time elapse between inserting electrode and recording final reading?	___	___
618	Is the electrode response slow?	___	___

Conductivity

The auditor is to ask the site operator to determine the conductivity of test solutions in exactly the same way as determined for a precipitation sample. The auditor is to give the operator the following test solutions (contained in polyethylene bottles) for testing.

- Solution of simulated precipitation (the same one used to test pH meter)

The auditor is to observe the operator carry out his standard procedure for conductivity as given in Section 3.3.3 of Reference (4). The auditor is to allow the site operator to work alone and to answer the following questions concerning adherence to standard procedures for internal meter checks, calibration and sample analysis.

Data from test to be entered by site operator on a FORF as a normal rain sample.

TABLE A-4. SURVEY RESULTS FOR CONDUCTIVITY

701 Site Conductivity Meter: Make ________ Model ________ S/N ______

702 Site Conductivity Cell: Make ________ Model ________ S/N ______

Solution	Site Value (μmho/cm)	Audit Value (μmho/cm)
703 Site DI H_2O	________	
704 Site's 0.0005M KCl	________	
705 Simulated Rain Sample (Corrected)	________	________

	Yes	No
706 Does site have a YSI type cell?	___	___
707 Is the YSI type conductivity cell used in the recommended (inverted) manner?	___	___
708 Does site conductivity meter have calibration adjustments?	___	___
709 Is the conductivity meter calibrated before beginning test run?	___	___
710 Is the conductivity cell rinsed thoroughly with deionized water between samples?	___	___

		Yes	No
711	Is the conductivity standard tested before deionized water?		
712	Is the conductivity cell rinsed with an aliquot of sample then another aliquot of the sample added and measured? (YSI type cell)		
713	Are sample conductivity values corrected for the measured value of the conductivity standard (i.e., sample measured x standard value ÷ standard measured value = sample corrected)?		
714	Is the conductivity cell rinsed with deionized water before storing?		
715	How is conductivity cell stored?		

Mass

As part of the performance survey, the station operator is to prepare the balance for use and weigh a number of weights to be supplied by RTI.

Weights are to be added to the balance one at a time and the total mass measured after each addition. All data are to be entered in Table A-5.

TABLE A-5. SURVEY RESULTS FOR BALANCE

Site Name ______________________
Date of Survey ______________________
Operator's Name ______________________
Surveyor's Name ______________________

801 Balance Name __________ Balance Model Number __________

Survey Weight(s) (g)	Total Survey Mass (g)	Balance Reading (g)	Difference, g Balance Reading - Survey Weight

802 Balance Name __________ Balance Model Number __________

Survey Weight(s) (g)	Total Survey Mass (g)	Balance Reading (g)	Difference, g Balance Reading - Survey Weight